TRANSACTIONS

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of
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and
OTOLARYNGOLOGY

JANUARY - FEBRUARY
1950

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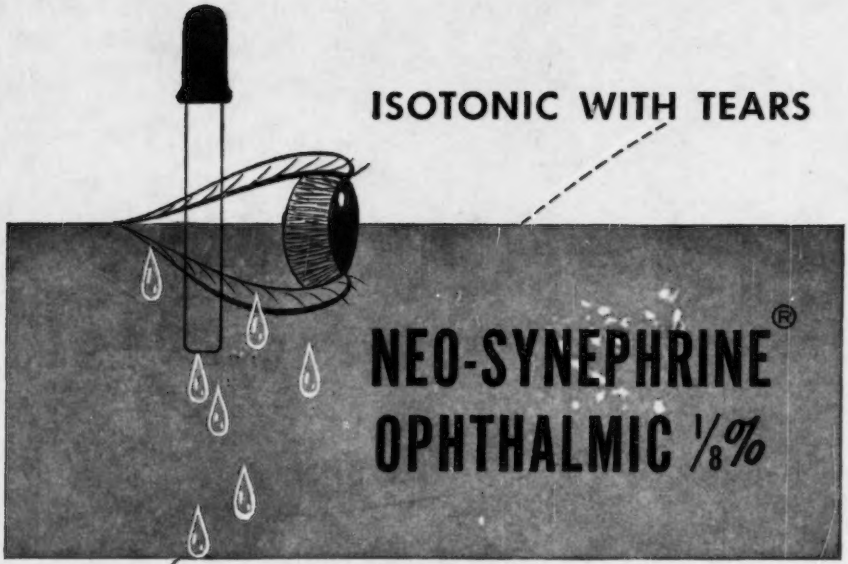
ANNUAL MEETING OCTOBER 8-13, 1950, CHICAGO



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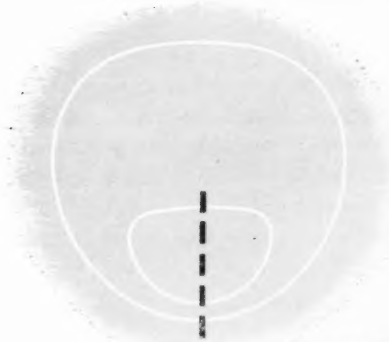

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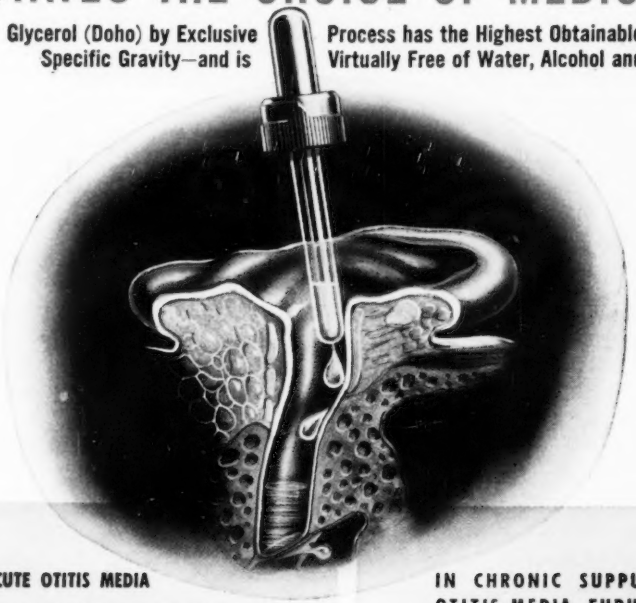

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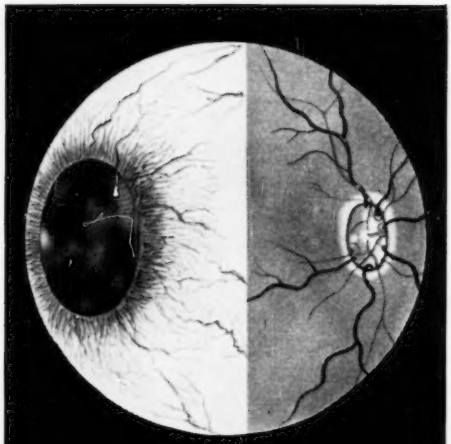

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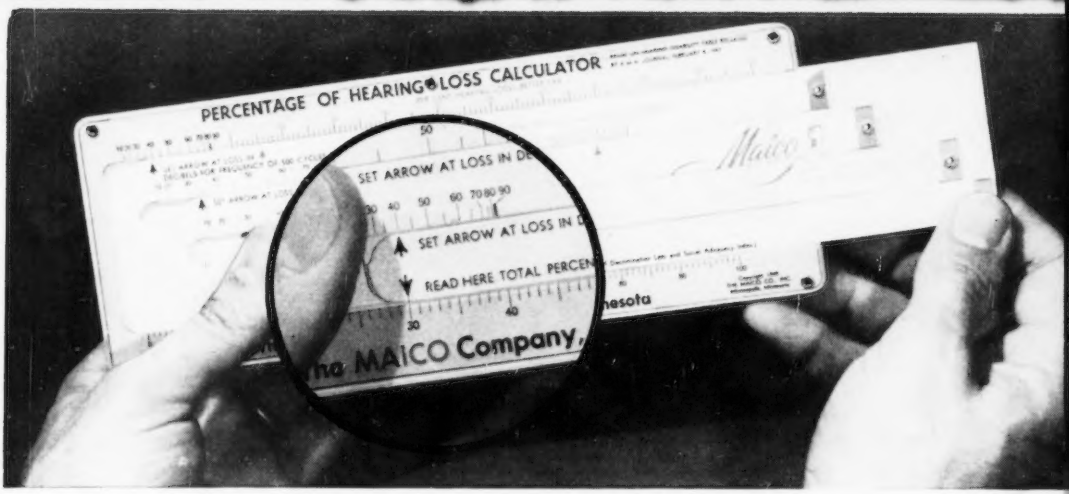

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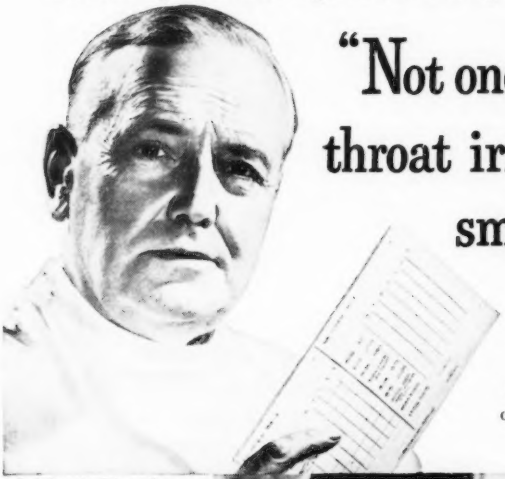

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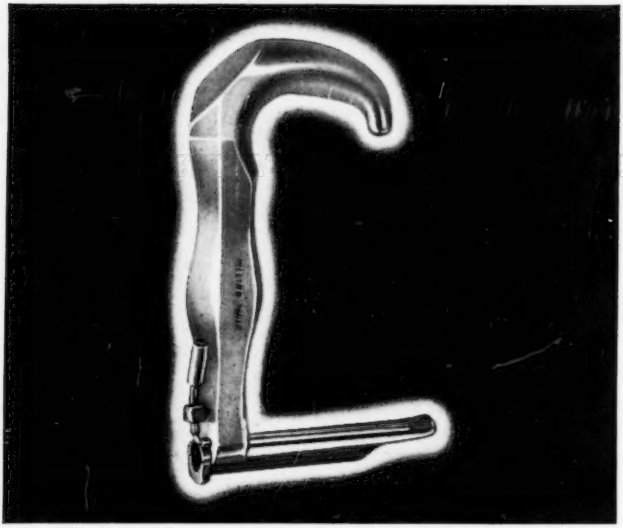

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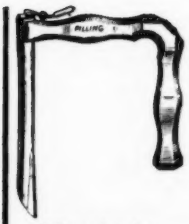

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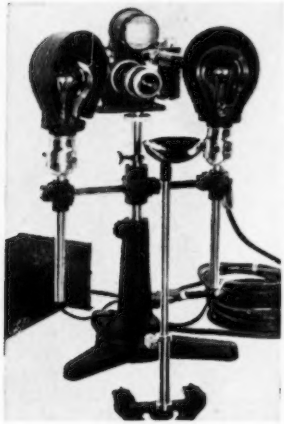

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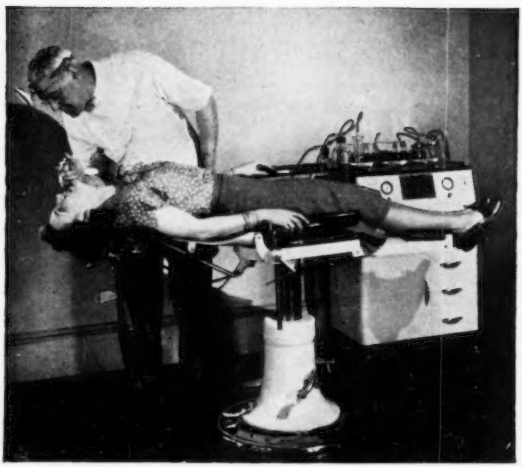

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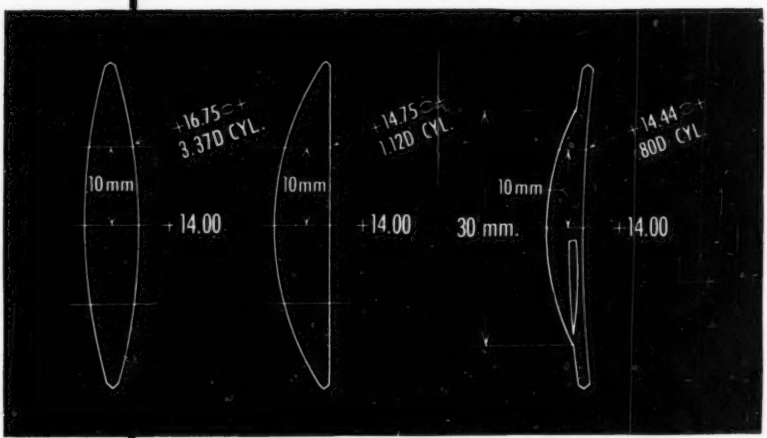

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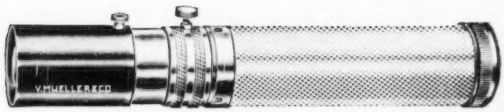

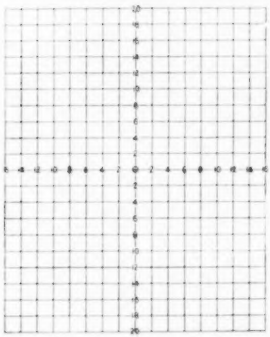

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INTRODUCTION OF SUBJECT

FRANK B. WALSH, M.D.
BALTIMORE, MD.

THE programs of the Academy meetings in years past have included symposiums on important disease entities or some form of treatment. Toxoplasmosis is the disease under consideration this year. My part of the symposium includes a brief historical note, a description of the neurologic signs, and comments concerning differential diagnosis. General and ocular signs as well as certain laboratory examinations which are essential to the diagnosis are described by my colleagues.

DEFINITION

Toxoplasmosis is an infection which occurs in humans, birds, animals, reptiles and fishes. It is widely distributed throughout the world.

HISTORY

The investigations which have established toxoplasmosis as a disease of the human race are important in exemplifying the internationalism of medical science. Before mentioning several outstanding papers in chronologic order, attention must be drawn to the interesting fact that an ophthalmologist in Prague, J. Janku,[8] described the first case of toxoplasmosis and noted both the cerebral and ocular involvement.

1900. Leveran[9] described an organism, probably Toxoplasma, in Javanese paddy-birds.

1908. Nicolle and Manceaux[10] observed in African rodents (gondi) an organism which they termed Toxoplasma, a protozoan.

1923. Janku,[8] an ophthalmologist, described encephalomyelitis and chorioretinitis with parasitic cysts in a patient. These findings were confirmed by Levaditi (France) in 1924 as human infection with Toxoplasma.

1935. Sabin and Olitsky,[16] using human brain tissue, reproduced the disease in animals. In 1937 they described neutralizing antibodies in experimentally infected animals.

1938. Wolf and Cowen[18] recognized in an infant's brain, cord and eyes the organisms (Toxoplasma) observed by Sabin and Olitsky in animals. They, together with Paige, reported on the disease in an older child in 1939, and in 1940 in adults as a generalized infection with pulmonary involvement.

1940. Dyke, Wolf, Cowen, Paige and Caffey[5] wrote fully regarding the x-ray findings.

1941. Sabin[14] found neutralizing antibodies in human serum.

1942. Cowen, Wolf and Paige[4] wrote concerning surviving cases.

1946. Callahan, Russell and Smith[2] wrote a review.

1948. Binkhorst's authoritative monograph[1] was published.

From the Wilmer Ophthalmological Institute of the Johns Hopkins Hospital and University.
Presented at the Fifty-Fourth Annual Session of the American Academy of Ophthalmology and Otolaryngology, Oct. 9-14, 1949, Chicago, Ill.

PATHOLOGY

Before considering the essential pathologic condition as it occurs in the central nervous system it should be stated that the disease is described as occurring in three forms or types: the acute infantile, the subacute infantile (concerning which several completely reliable reports are available), and the chronic. The acute infantile disease is characterized by widespread involvement, with many body organs affected and many of the involvements of microscopic dimensions. The duration of this stage or phase of the disease is uncertain, probably short, and in most instances commences in utero. The subacute stage seemingly is characterized by regression of the extraneural foci and by continued activity of the disease within the nervous system and eyes. It is with this stage of the disease and its end results that we are most familiar. Evidence of former and persistent damage, probably also recurrent involvement, may properly be considered as the chronic stage.

Descriptions of the acute and subacute cerebral involvements have been taken in large part from the paper by Callahan, Russell and Smith.[2] The piarachnoid is infiltrated with lymphocytes, plasma cells, monoculears and eosinophils seemingly as a response to underlying cortical involvement. The gyri, sulci and subarachnoid space may be obliterated. Changes in the cerebral cortex vary from small foci of cellular infiltration (the so-called microglial nodule) to large zones of necrosis. The microglial nodule is the characteristic lesion. Such lesions account for necrosis and cyst formation. Organisms may be discovered near or in areas of necrosis or within the microglial nodules. Proliferation and swelling of large astrocytes in the brain tissue about the nodules may account for the appearance of atypical giant cells. Foci of calcification occur within the scattered zones of necrosis. These calcified areas may be discrete or scattered diffusely, appearing in roentgenograms as "calcium dust"; in some instances broad bands of calcified material are seen. Necrosis is followed by gliosis and fibrosis. The basal ganglia may be affected in the same manner as the cortex. A characteristic and unique lesion is the periventricular reaction zone as described by Frenkel.[6] He observed four zones which, from without toward the ventricle, are: (1) a zone of cellular infiltration with thrombosis of capillaries, (2) thrombosis of large vessels, (3) cellular necrosis, and (4) a zone of repair. Deposits of calcium may surround the ventricle in the outer zones. The ventricles may be dilated and the aqueduct may be partially or completely obstructed. The ventricular fluid has a high protein content and organisms often may be obtained from it. Cortical atrophy may explain dilatation of the ventricles in cases of microcephaly or when the head is of normal size. The cerebellum is rarely extensively affected. The pons is frequently the site of pronounced involvement; the tegmentum and the pontine nuclei are likely to be affected. The changes in the medulla are similar to those in the pons. The spinal roots are not affected. Transverse myelitis has been observed.[2,4]

CLINICAL MANIFESTATIONS

Toxoplasmosis has been recognized in stillborn infants, in infants who may have acquired it before or after birth, in young children, and in adults. In many published cases the diagnosis has been established by autopsy studies, animal experimentation, serologic tests and, in a minority, by recovery of the organism. In practice the diagnosis is generally acceptable on the basis of a combination of neurologic, roentgenologic, and ocular findings.

Minimal infections with Toxoplasma occur, and in all probability we have been diagnosing only those cases in

which the original infection was relatively severe and widespread. It has been estimated that 10 per cent of the normal population possess Toxoplasma antibodies. This does not mean that 10 per cent of the population have asymptomatic toxoplasmosis because in some instances the antibodies may be nonspecific.

Toxoplasmosis in Infants and Children

Frenkel[6] has divided the disease into acute, subacute and chronic stages, but the division is not at all sharp in many instances. Certainly a majority of cases seen clinically are either subacute or chronic (which includes the stage of residua). Seemingly the disease may become latent only to become reactivated later.

The descriptions which follow are based largely on papers written by Sabin,[13,14] Wolf and Cowen,[17,18] Callahan and his associates,[2] Frenkel,[6] and Binkhorst.[1] Our experience in the Johns Hopkins Hospital has been extremely limited if completely proved cases are required. Heidelman[7] studied our material up to 1945. He was interested in neutralizing antibodies as an important part of the diagnosis. In only a single case have Toxoplasma been recovered. The diagnosis has been seemingly verified in several cases by identification of the neutralizing antibodies. The diagnosis has seemed probable in 25 cases.

The acute disease. In a minority of cases the disease is acute when the patient is first seen. In such cases the signs are those of irritation as the result of either meningitis or encephalitis. Such patients have an elevation of temperature, stiff neck, and tremors and spasms of the extremities which develop into convulsions. As the acute disease subsides, neurologic signs tend to become prominent.

The subacute and chronic disease. In addition to ocular signs, which include loss of vision, chorioretinitis, microphthalmos, strabismus and nystagmus, there are extremely variable neurologic signs. The hydrocephalus may progress. There may be continuance or later appearance of generalized or jacksonian convulsive seizures or petit mal attacks. Brain stem involvements may account for nystagmus, strabismus, hemiplegia, or spastic paraplegia. Varying degrees of mental and physical retardation, speech impediment, emotional lability and hyperkinesia are seen.

Principal symptoms and signs. There are five principal features: (1) convulsions, (2) hydrocephalus, (3) mental deficiency, (4) cerebral calcification, and (5) chorioretinitis.

1. Convulsions. Generalized and focal convulsions have occurred in 60 to 70 per cent of the reported cases. Transient spinal and bulbar symptoms sometimes follow the generalized convulsions and result in paralysis of the extremities and difficulty in swallowing and breathing.

2. Hydrocephalus is present in 80 per cent of infantile cases. It is obstructive in type and is due to closure of the aqueduct of Sylvius and/or the foramen of Monro. The hydrocephalus may be of sufficient size to interfere with birth. When it develops after birth it is usually progressive. However, although hydrocephalus and a large head are the rule, microcephaly is occasionally observed. Presumably, microcephaly is due to extensive antenatal cerebral necrosis.

3. Mental deficiency in some degree is present in a majority of severe cases. However, we have observed young children exhibiting pronounced ocular and roentgenographic evidence of the disease, who had almost a normal mentality when seen several years later.

4 and 5. Cerebral calcification is described subsequently. The ocular signs will be described by Dr. Hogan.

Adult Toxoplasmosis

Descriptions of only 4 proved cases of adult toxoplasmosis have come to my attention.[2,11] Those cases are briefly summarized.

The lesions in the central nervous system are minimal as compared with those in the infantile disease. The clinical symptomatology usually fails to indicate central nervous system involvement. The clinical picture usually is that of an infectious disease, often with pronounced pulmonary involvement. Sometimes a rash is present. The clinical picture may closely resemble Rocky Mountain spotted fever or typhus.[11] Callahan and his associates[2] described a single case in which the cerebral autopsy findings were similar to those seen in the infantile form.

DIAGNOSIS

The diagnosis is suspected when a patient who has had convulsions is found to exhibit chorioretinitis and cerebral calcification. This triad seemingly is almost pathognomonic of the disease. There is nothing characteristic about the convulsions, and since convulsions occur so frequently during infancy they, by themselves, cannot be evaluated. Cerebral calcification occurs in a variety of disease states, as does also chorioretinitis. The chorioretinitis of toxoplasmosis varies within wide limits. It is the combination of these signs that points to the diagnosis, as has recently been elaborated by Sabin and Feldman.[15] They have shown that when chorioretinitis and cerebral calcification occur in infancy, the chances are 9:1 that the diagnosis is toxoplasmosis. Conversely, if chorioretinitis is not associated with cerebral calcification, there is a 9:1 chance that the diagnosis is not toxoplasmosis. Further, they have described a syndrome of cerebral calcification and chorioretinitis with extensive brain destruction which occurs in infancy and can be distinguished from toxoplasmosis only by serologic tests or pathologic examination.

It has already been remarked that minimal cases of toxoplasmosis occur. These are likely to be overlooked if it be insisted that the three cardinal features of the disease (convulsions, chorioretinitis and cerebral calcification) are necessary to the diagnosis. In many instances the diagnosis will remain in doubt until refined serologic tests are made a part of the diagnostic equipment.

Roentgenographic Features

Dyke and his co-workers[5] have described the roentgenographic features of the disease as follows: (1) Microcephaly and, more often, macrocephaly with hydrocephalus are seen. (2) There may be evidences of increased intracranial pressure in bulging of the anterior fontanel, atrophy of the posterior clinoid processes and dorsum sellae, and separation of the sutures. (3) Intracranial calcifications, which usually measure 1 to 3 mm. in diameter, may occur in all parts of the cerebral cortex, and in the basal ganglia and thalami. In the basal ganglia and thalami the calcifications occur as curved streaks and are said to be characteristic. In some instances the calcifications are very small and appear like calcium dust. Calcifications may be present at birth. They have been seen to increase in size and number. It must be emphasized that calcifications are not present in every case.

Laboratory Evidence Supporting the Diagnosis

Hydrocephalus is readily demonstrated by ventricular or spinal air injection. In many instances such studies are unnecessary since the hydrocephalus is pronounced. When the process is active, the spinal fluid often is xanthochromic and exhibits pleocytosis (lymphocytes and mononuclears). The ventricular and spinal fluid has a high protein content. Toxoplasma may be isolated from the spinal and ventricular fluid. However,

many cases are diagnosed when the process has long ceased to be active, and in these spinal fluid may be quite normal.

DIFFERENTIAL DIAGNOSIS

Examination of our material, which has not included adult cases, shows that toxoplasmosis should be suspected in cases characterized by convulsions, chorioretinitis and cerebral calcification. There are many such cases. From our records it would seem that the conditions which most frequently are confused with toxoplasmosis are tuberous sclerosis, subdural hematoma in infants, and retrolental fibroplasia.

Tuberous sclerosis often is characterized by convulsions, areas of calcification along the roofs of the lateral ventricles, and areas of increased density in the inner table. Also there are intraocular changes which, however, are quite unlike those seen in toxoplasmosis.

Subdural hematoma in infants should not be confused with toxoplasmosis, but it was mentioned as a possibility in several of our cases.

Retrolental fibroplasia was suggested as the diagnosis in 3 of our cases of toxoplasmosis. Ridley[12] recently described a case which falls into this category. The history of a case of microphthalmos, unilateral, in a child with inflammatory membrane in the anterior vitreous of both eyes and central healed chorioretinitis in one eye and areas of calcification in the brain is summarized to emphasize the similarity of the ocular findings in these diseases.

B. P., a white female, 2 years of age, was seen through the courtesy of Dr. Jack Guyton. The parents sought advice regarding the child's vision, which was defective.

The child was born at term. The left eye was noticeably smaller than the right at birth. At 4 months the infant developed generalized convulsions. Measurements of the head showed that it had failed to grow when the child reached 1 year of age but commenced growing two months before our examinations were made.

The left eye was microphthalmic; the cornea measured 8 mm. in diameter, whereas the cornea of the right eye measured 10½ to 11 mm. The right pupil reacted promptly. The left pupil reacted but posterior synechias were observed. The anterior segments otherwise appeared normal in both eyes. The pupils were dilated.

Ophthalmoscopic examination of the right eye showed an inflammatory cyclitic membrane behind the lens in the upper temporal portion of the anterior vitreous; most of this membrane was not particularly dense. The fundus could be seen clearly. There was a large circumscribed area of healed chorioretinitis in the region of the macula. Otherwise the fundus was normal. In the left eye there was a much denser and more extensive membrane in the anterior vitreous. Probably through contraction of the membrane, the ciliary processes could be seen plainly. The fundus could not be seen.

X-ray report. There is pronounced microcephaly. There are bilateral areas of calcification anteriorly in the brain substance. These are compatible with the diagnosis of toxoplasmosis.

The presence of intracranial cerebral calcification should always suggest the possibility of toxoplasmosis. Camp[3] has recently written a valuable paper on pathologic non-neoplastic intracranial calcification. He described calcification of the carotid; in aneurysms, where it is not a common finding; in the Sturge-Weber syndrome; within subdural and intracerebral hematomas; in tuberculoma; in cysticercosis, in torulosis, and in trichinosis (where calcified areas are much more commonly seen in muscles than in cerebral tissue); associated with cerebral atrophy (also facial hemiatrophy); and in parathyroid deficiency. We have observed calcification in several types of tumor: craniopharyngioma, oligodendroglioma, occasionally meningioma, cerebral dermoid, and ependymoma. Calcification occurs frequently as a normal finding. It may be seen in the pineal gland, choroid plexus, falx, and the petrosphenoid ligament. Foreign bodies, as well as radiopaque material (pantopaque), may be mistaken for calcification.

SUMMARY

The neurologic symptomatology of toxoplasmosis may vary within wide limits. Chorioretinitis, cerebral calcification and convulsions should always suggest the diagnosis as a probability. Mild cases probably occur frequently and remain undiagnosed.

REFERENCES

1. Binkhorst, C. D.: Toxoplasmosis, Leiden, H. E. Stenfert Kroese, 1948.
2. Callahan, W. P., Jr., Russell, W. O. and Smith, M. G.: Human toxoplasmosis: a clinicopathologic study with presentation of five cases and review of the literature, Medicine, 25:343-397 (Dec.) 1946.
3. Camp, J. D.: Pathologic non-neoplastic intracranial calcification, J.A.M.A., 137: 1023-1030 (July 17) 1948.
4. Cowen, D., Wolf, A. and Paige, B. H.: Toxoplasmic encephalomyelitis: VI. Clinical diagnosis of infantile or congenital toxoplasmosis; survival beyond infancy, Arch. Neurol. & Psychiat., 48:689-739 (Nov.) 1942.
5. Dyke, C. G., Wolf, A., Cowen, D., Paige, B. H. and Caffey, J.: Toxoplasmic encephalomyelitis: VIII. Significance of roentgenographic findings in the diagnosis of infantile or congenital toxoplasmosis, Am. J. Roentgenol., 47:830-841 (June) 1942.
6. Frenkel, J. K.: Pathogenesis, diagnosis, and treatment of human toxoplasmosis, J.A.M.A., 140:369-377 (May 28) 1949.
7. Heidelman, J. M.: Evaluation of Toxoplasma neutralization tests in cases of chorioretinitis, Arch. Ophth., 34:28-39 (July) 1945.
8. Janku, J.: Pathogenesa a pathologická anatomie tak nazvaného vrozeného kolombu zluté skvrany voku normálně velikem a microphthalmickém s nálezem parasitu v sitnici [Pathogenesis and pathologic anatomy of coloboma of the macula lutea in an eye of normal dimensions, and in a microphthalmic eye, with parasites in the retina], Casop. lék. cesk., 62:1021, 1052, 1081, 1111 and 1138, 1923.
9. Leveran, A.: Au suject de l'hématoxoaire endoglobulaire de Padda oryzivora, Compt. rend. Soc. de biol., 52:19, 1900.
10. Nicolle, C. and Manceaux, L.: Sur une infection à corps de Leishman (organismes roisins) du gondi, Compt. rend. Acad. d. sc., 147:763, 1908.
11. Pinkerton, H. and Henderson, R. G.: Adult toxoplasmosis: a previously unrecognized disease entity simulating the typhus-spotted fever group, J.A.M.A., 116:807-814 (March 1) 1941.
12. Ridley, H.: Toxoplasmosis, a summary of the disease with report of a case, Brit. J. Ophth., 33:397-407 (July) 1949.
13. Sabin, A. B.: Biological and immunological identity of Toxoplasma of animal and human origin, Proc. Soc. Exper. Biol. & Med., 41:75-80 (May) 1939.
14. ———: Toxoplasmic encephalitis in children, J.A.M.A., 116:801-807 (March 1) 1941.
15. Sabin, A. B. and Feldman, H. A.: Chorioretinopathy associated with other evidence of cerebral damage in childhood: a syndrome of unknown etiology separable from congenital toxoplasmosis, J. Pediat., 35: 296-309 (Sept.) 1949.
16. Sabin, A. B. and Olitsky, P. K.: Toxoplasmosis and obligate intra-cellular parasitism, Science, 85:336-338 (April 2) 1937.
17. Wolf, A. and Cowen, D.: Granulomatous encephalomyelitis due to an encephalitozoon (encephalitozoic encephalomyelitis): a new protozoan disease of man, Bull. Neurol. Inst. New York, 6:306-371 (Aug.) 1937.
18. ———: Granulomatous encephalomyelitis due to a protozoan (Toxoplasma or Encephalitozoon): II. Identification of a case from the literature, Bull. Neurol. Inst. New York, 7:266-290 (Dec.) 1938.

OCULAR MANIFESTATIONS

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THE chorioretinitis and associated ocular changes which occur in human congenital and infantile toxoplasmosis constitute an important feature of this disease. They are observed in a high percentage of the cases.

Human toxoplasmosis was not recognized prior to 1937. Up to this time the ophthalmologist frequently encountered infants and children, or even adults, with healed areas of chorioretinitis, the cause of which was unknown. These lesions were frequently termed "fetal chorioretinal infection," "congenital developmental anomaly of the retina and choroid," or "birth injury with hemorrhage." Subsequent to the original description of a patient with congenital toxoplasmic encephalomyelitis by Wolf and Cowen[13] a number of cases were reported in which antenatal or natal inflammation was present in the retina and choroid in one or both eyes.[14,15] Within a short time it was demonstrated that these lesions were due to Toxoplasma and were identical with those seen in toxoplasmic encephalomyelitis.[9,14,15]

Almost all new cases are now recognized immediately by pediatricians, internists, roentgenologists, and ophthalmologists. Within the past few years the number of recognized cases has increased rapidly.

Acute uveitis apparently does not occur in acquired juvenile and adult toxoplasmosis.[10,11,12]

ETIOLOGY

Toxoplasma is regarded as a protozoan parasite. It possesses a distinct cytoplasm and nuclear chromatin. The chromatin is not definitely surrounded by a nuclear membrane. The organism varies in its appearance depending upon the method of preparation and its stage of development (fig. 1). It varies in size from 4 to 7 microns in length and from 2 to 4 microns in width in fresh unstained slides. Stained sections of fixed tissues show it to be smaller. It is seen within cells of the reticulo-endothelial system, mononuclear phagocytes, and parenchymal cells but may be free in the tissues (fig. 2). Recently divided parasites are crescentic in shape, with one rounded and one pointed end. Reproduction occurs by binary fission.

The parasite cannot be propagated upon artificial media. It can, however, be grown on embryonated hens' eggs and is easy to maintain in a variety of laboratory animals.[8]

EPIDEMIOLOGY

The mode of transmission of this parasitic infection from animal to animal or to humans has as yet not been demonstrated. Toxoplasma has been demonstrated in a large variety of animals under natural conditions. Mammals, birds, Amphibia, reptiles, and fish

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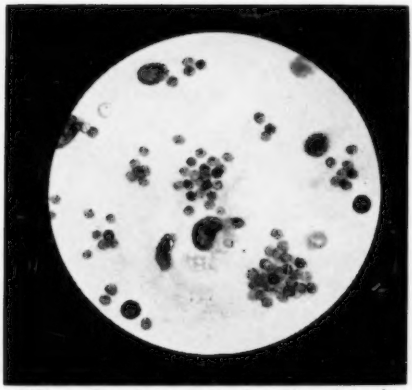

FIG. 1—Toxoplasma in fresh peritoneal exudate formalin fixation, Giemsa stain.

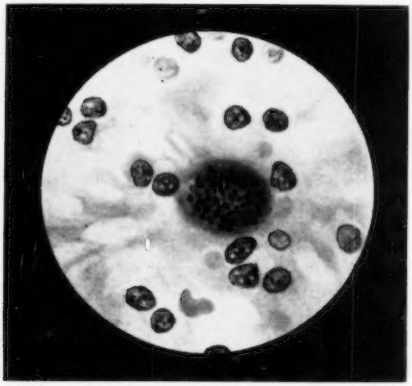

FIG. 2—Drawing of a Toxoplasma pseudocyst in the retina.

have been shown to be naturally infected.

Laboratory animals and domestic animals have also been found to be naturally infected. This suggests the possibility that the disease may be transmitted by the ingestion of food. A number of cases have been reported in which the patient became ill after contact with ticks. It is possible that a vector will be found which transmits the disease from animals to the human.

Since the largest number of reported cases has occurred in newborn infants or within the early postnatal period, attempts have been made to ascertain the method by which the fetus becomes infected. In most instances the mothers of infected children have been entirely well during the course of their pregnancy. It is probable that the mothers may harbor the parasite and that the changes incident to pregnancy result in its proliferation and spread to the fetus via the placental circulation. A fetal infection usually occurs in the later months of pregnancy.

PATHOGENESIS

A marked predilection of the disease to affect the central nervous system of the developing fetus has been shown in congenital toxoplasmosis. The eye is an outgrowth of the central nervous system and seems to be affected in a similar fashion. Since the retina is a neuroectodermal structure, it would be expected to participate in the encephalomyelitis which develops.

The parasites enter the eye by way of the retinal or choroidal blood vessels and lodge in the finer capillaries. The adjacent structures are then rapidly invaded, and the result is the characteristic lesions which have been described in this disease.

If the infection of the eye occurs at an earlier stage of fetal development (six months), severe damage and an arrest in development may occur. If the infection occurs at a later date (seventh to eighth month), less damage results from a developmental standpoint and the eye may acquire its normal size. The inflammation may develop near term or within the early postnatal period. In cases of this type the chorioretinal infection is in the acute stage at the time of examination.

In some cases the cerebral and ocular infection may be unrecognized and the effects are not apparent until the child is older. At this time the child may manifest poor vision and mental retardation. Examination usually shows a bilateral

healed chorioretinitis. General physical examination and roentgenograms reveal the other manifestations of the disease.

It is thought that an infected patient may subsequently harbor parasites intracellularly in his tissues and have a chronic latent infection. The parasites may be liberated at some later date and result in reactivation of the infectious process.

Approximately 78 cases of congenital human toxoplasmosis with an associated chorioretinitis, in which the diagnosis was considered proved or probable, have been reported. These ocular changes constitute one of the most important signs of this form of the disease.

Thirty-three eyes in these 78 cases showed lesions confined solely to the macula. Thirty-four eyes showed multiple lesions involving the macula and other portions of the retina. Twenty-two eyes showed one or more lesions not involving the macula. The site and character of the lesions in the remaining 67 eyes were not indicated.

Thirty-four eyes in these 78 cases were described as exhibiting an acute chorioretinitis (16 in the right eye and 18 in the left eye). Sixty-four eyes showed a healed chorioretinitis (34 in the right eye and 30 in the left eye).

Thirty-seven eyes showed microphthalmos (19 in the right eye and 18 in the left eye).

Thirty-three eyes showed optic atrophy, partial or complete (18 in the right eye, 15 in the left eye).

Thirty-three eyes exhibited various types of strabismus.

Chorioretinitis of varied activity is the most prominent manifestation noted in the eyes. It is almost always bilateral and is commonly macular in position, but multiple lesions are frequently encountered. The principal findings which have been noted in the eyes of patients with this disease are: (1) nystagmus, (2) deviation of the eyes, (3) microphthalmos, (4) iridocyclitis with synechias, (5) cataract, secondary to uveitis, (6) vitreous opacities and fibrosis, (7) chorioretinitis, (8) optic atrophy, and (9) papilledema due to hydrocephalus.

Some of the ocular changes result from the severe encephalitis which is present. Nystagmus and deviation of the eyes may result either from poor fixation as a result of the chorioretinitis or from involvement of the brain. Microphthalmos may be present in one or both eyes and usually signifies an infection in the fetus at the earlier stage. The inflammatory process in the choroid and retina results in arrested development of the eyes. It is usually more marked in one eye than the other. The chorioretinitis may also result in numerous vitreous opacities and proliferation of glial and fibrous tissue into the adjacent vitreous. Iridocyclitis may occur, either as a primary lesion or as a result of the chorioretinitis. It is usually mild in character and may result in posterior synechias. The optic atrophy which is noted may either result from the chorioretinitis or be secondary to papilledema from the hydrocephalus. Papilledema is almost invariably present if internal hydrocephalus occurs and eventually results in a variable degree of atrophy of the optic nerve. Complicated cataract may occur as a sequela of severe posterior ocular infection.

The chorioretinitis which occurs is said by some authors to be characteristic and diagnostic of the disease. Other investigators deny that the lesions are specific in character. The appearance of the lesions differs according to the stage of onset and degree of activity.

Acute Lesions

The principal foci of chorioretinitis are usually bilateral and are located in the posterior portion of the eye.[7] The macular area seems to be especially in-

volved (fig. 3). The early lesions are usually large and have a yellowish or gray-yellow appearance. The margins are ill defined and the retina in the affected area is usually elevated. Small hemorrhages and exudates may be scattered within the acute foci and adjacent areas.

The inflamed areas may be single or multiple. Small satellites are commonly noted around the principal focus. If the infection occurs in the region of the disk, there is usually an associated papillitis. Numerous vitreous opacities are usually present and obscure the details of fundus examination.

FIG. 3.—Acute chorioretinitis due to Toxoplasma.

The acute inflammation soon passes to the subacute stage and the inflammatory focus becomes more circumscribed. The hemorrhages and exudates within and around the focus disappear. Beginning proliferation of the pigment may be noted at the borders of the lesion.

Chronic Lesions

The chronic phase commences with subsidence of the acute inflammation. It lasts an indefinite time, depending on proliferation of the parasites or their parasitization by tissue cells and phagocytes. In the 1 case we have observed with an acute chorioretinitis due to Toxoplasma five months were required before the chronic stage was reached.

The lesions at this time show beginning atrophy in the central portion. The degree of atrophy depends upon the amount of necrosis and destruction which occurs in the inflammatory foci. There is usually rather extensive necrosis so that severe central atrophy is common. At the same time there is proliferation of pigment at the margins and toward the center of the atrophic area. Optic atrophy corresponding to the healed chorioretinal lesions in the fundus is commonly seen. There may be complete atrophy due to the previous papilledema.

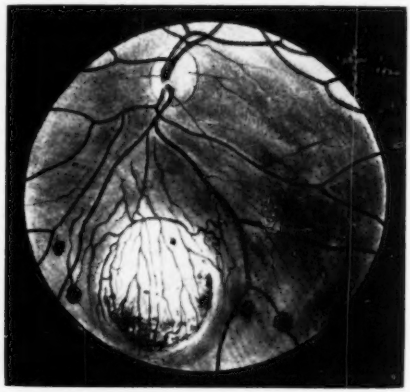

FIG. 4.—Healed congenital chorioretinitis due to Toxoplasma.

Healed Lesions

A healed focus of toxoplasmic chorioretinitis has the same appearance as one due to any other cause (fig. 4). If the healed lesions are bilateral and macular and are seen in children, the diagnosis of toxoplasmosis is strongly suggested and further investigations are needed to confirm this impression.

OCULAR HISTOPATHOLOGY

There has as yet been no histopathologic description of the earliest stages of toxoplasmic chorioretinitis. Histopatho-

logic findings in the eye have been recorded in approximately 13 cases.[1,2,4,5,9,16] In all instances the eyes were removed at autopsy. The inflammatory and associated changes noted in these eyes depended upon the stage of life at which the lesions developed.

In most of the reported eyes the primary site of inflammation occurred within the retina. Adjacent structures were secondarily affected. The choroid, however, may be the site of the primary inflammation. Most of the associated lesions in the eye result from the severe destructive inflammation in the choroid and retina. The retina and choroid are the site of an acute, circumscribed inflammation, which may be localized to one or more areas (fig. 5). In the inflamed zones there is capillary engorgement and marked infiltration of inflammatory cells, mainly polymorphonuclear leukocytes, lymphocytes, plasma cells, and macrophages. Occasional eosinophils are seen. There is extensive edema of the fiber and nuclear layers. As a result, disruption and disorganization of the retinal tissues occur. Necrosis usually develops in the central portion of these inflammatory zones (fig. 5). Toxoplasma may be found both intra- and extracellularly in the zone surrounding the most acute site of inflammation and necrosis (figs. 6 and 7). The inner and outer limiting membranes of the retina may be interrupted, and glial and connective tissue may proliferate from the inner retina into the adjacent vitreous cavity. If the external limiting membrane is interrupted, there is usually dislocation of the rod and cone nuclei into the subretinal area (fig. 8). The retinal pigment epithelium usually shows marked destruction beneath the acute foci. Pigment migrates into the subretinal exudate and into the inflamed retina. Older lesions show proliferation of the pigment which borders the inflammatory focus.

FIG. 5—Acute retinitis near disk.

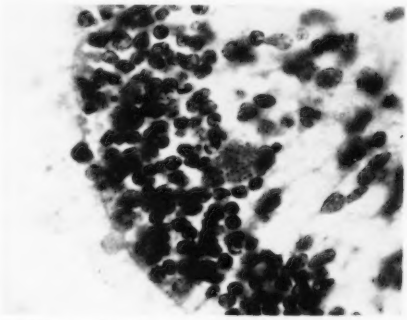

FIG. 6—Intracellular Toxoplasma in retina.

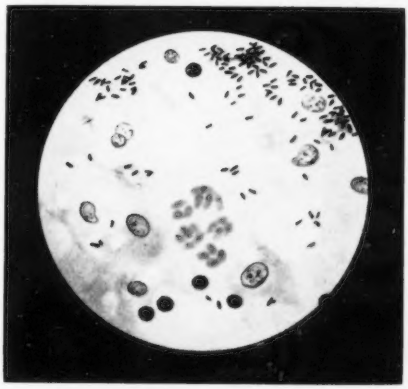

FIG. 7—Extracellular parasites in the retina.

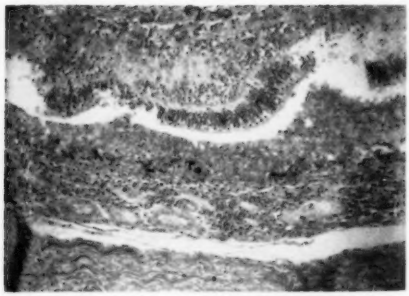

FIG. 8.—Acute toxoplasmic chorioretinitis. Interruption of external limiting membrane.

The choroidal inflammation is usually most acute beneath the retinal zone of inflammation and is rather well demarcated. The principal infection may lie within the choroid in some cases. The lamina vitrea is frequently destroyed, with proliferation of connective tissue from the choroid into the subretinal area to bind both retina and choroid in a scar.

Healed foci of chorioretinitis usually show considerable atrophy of both the retina and choroid with fusion of these two layers (fig. 9).

The iris and ciliary body may show a moderate inflammation, most often secondary to the changes in the posterior segment. Typical foci of inflammation with parasites have not been noted in these structures. The lens may be cataractous as a result of the chorioretinitis and iridocyclitis. The optic disk may show either a papilledema, as a result of hydrocephalus, or a papillitis, secondary to the focal areas of inflammation in the adjacent retina. At times the inflammation may extend backward in the nerve a short distance beyond the eyeball in the perivascular spaces.

FIG. 9.—Healed chorioretinitis due to Toxoplasma. Retinal and choroidal atrophy.

The leptomeninges around the optic nerve may show small foci of perivascular inflammation, and the subarachnoid space may contain moderate numbers of inflammatory and phagocytic cells which have extended peripherally along the subarachnoid space from the brain. Parasites, however, have not been demonstrated at these sites.

SUMMARY

1. The chorioretinitis and associated ocular changes which occur in human congenital toxoplasmosis form an important diagnostic sign of this disease.

2. Toxoplasma has an affinity for the central nervous system of the developing fetus and infant. The retina is a derivation of neural ectoderm and participates in this central nervous system infection in a high percentage of cases.

3. The changes which are noted in the eyes of infants with this disease result from a direct infection of the choroid and retina by Toxoplasma and from involvement of the brain.

4. Direct involvement of the retina by Toxoplasma is more frequently seen than a primary involvement of the choroid.

5. Nystagmus, ocular deviation, iridocyclitis, secondary cataract, and papilledema are the common associated ocular manifestations.

6. The papilledema results from an internal hydrocephalus which is common in this disease.

7. The optic atrophy noted in some infants may be due to direct involve-

ment of the optic nerve by parasites or may be secondary to a previous hydrocephalus.

8. An acute retinitis has been described histopathologically in all eyes removed at autopsy. The choroid usually shows secondary invasion. The retinal inflammation is circumscribed and characterized by its intensity and central necrosis. The parasites are usually found both intra- and extracellularly around the area of the inflammatory focus.

9. The chorioretinitis observed ophthalmoscopically most often affects the posterior portion of the eyeball and is commonly bilateral and macular. Satellite lesions are commonly noted. The peripheral fundus may show small to large zones of inflammation.

REFERENCES

1. Binkhorst, C. D.: Toxoplasmosis, Leiden, H. E. Stenfert Kroese, 1948.
2. Heath, P. and Zuelzer, W. W.: Toxoplasmosis (report of eye findings in infant twins), Tr. Am. Ophth. Soc., 42:119-132, 1944.
3. Heidelman, J. M.: Evaluation of Toxoplasma neutralization tests in cases of chorioretinitis, Arch. Ophth., 34:28-39 (July) 1945.
4. Hogan, M. J.: Toxoplasmic chorioretinitis, Tr. Pacific Coast Oto-Ophth. Soc., 28:83-102, 1947.
5. Janku, J.: Pathogenesa a pathologická anatomie tak nazvaného vrozeného kolombu zluté skvrany voku normálně velikem a microphthalmickém s nálezem parasitu v sitnici [Pathogenesis and pathologic anatomy of coloboma of the macula lutea in an eye of normal dimensions, and in a microphthalmic eye, with parasites in the retina], Casop. lék. cesk., 62:1021, 1052, 1081, 1111 and 1138, 1923.
6. Johnson, L. V.: Use of neutralizing antibody test in the diagnosis of human toxoplasmic choroiditis, Arch. Ophth., 36:677-684 (Dec.) 1946.
7. Koch, F. L. P., Wolf, A., Cowen, D. and Paige, B. H.: Toxoplasmic encephalomyelitis: significance of ocular lesions in the diagnosis of infantile or congenital toxoplasmosis, Arch. Ophth., 29:1-25 (Jan.) 1943.
8. MacFarlane, J. O. and Ruchman, I.: Cultivation of Toxoplasma in the developing chick embryo, Proc. Soc. Exper. Biol. & Med., 67:1-4 (Jan.) 1948.
9. Paige, B. H., Cowen, D. and Wolf, A.: Toxoplasmic encephalomyelitis: further observations of infantile toxoplasmosis; intrauterine inception of the disease; visceral manifestations, Am. J. Dis. Child., 63:474-514 (March) 1942.
10. Pinkerton, H. and Henderson, R. G.: Adult toxoplasmosis: a previously unrecognized disease entity simulating the typhus-spotted fever group, J.A.M.A., 116: 807-814 (March 1) 1941.
11. Pinkerton, H. and Weinman, D.: Toxoplasma infection in man, Arch. Path., 30: 374-392 (July) 1940.
12. Sabin, A. B.: Toxoplasmic encephalitis in children, J.A.M.A., 116:801-807 (March 1) 1941.
13. Wolf, A. and Cowen, D.: Granulomatous encephalomyelitis due to an encephalitozoon (encephalitozoic encephalomyelitis): a new protozoan disease of man, Bull. Neurol. Inst. New York, 6:306-371 (Aug.) 1937.
14. ———: Granulomatous encephalomyelitis due to a protozoan (Toxoplasma or Encephalitozoon): II. Identification of a case from the literature, Bull. Neurol. Inst. New York, 7:266-290 (Dec.) 1938.
15. Wolf, A., Cowen, D. and Paige, B. H.: Toxoplasmic encephalomyelitis: III. A new case of granulomatous encephalomyelitis due to a protozoon, Am. J. Path., 15: 657-694 (Nov.) 1939.
16. Zuelzer, W. W.: Infantile toxoplasmosis, with a report of three new cases, including two in which the patients were identical twins, Arch. Path., 38:1-19 (July) 1944.

Symposium: Toxoplasmosis

* * *

DIAGNOSIS AND TREATMENT

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BY INVITATION

WE are gathered here to discuss a disease about which we all know relatively little and I hope, therefore, that you will be very charitable with the speakers when they seem to disagree in talking about the same thing. Actually, in my own opinion, toxoplasmosis as a disease of human beings has been established only since 1939. Many of the observations accumulated since that time are on very solid ground—based on pathologic findings, morphologic demonstration of parasites in affected tissues and recovery of the organisms by animal inoculation. On the other hand, certain other observations, descriptions, and reports have gotten into the literature in the last 10 years in which the deductions relative to toxoplasmosis are without foundation. Specifically, many manifestations, particularly involving the eyes, which have been described as being due to toxoplasmosis are, in my opinion, not based on adequate evidence.

You know that I am not an ophthalmologist by profession, and I hope that you will be charitable when I slip in some of my ophthalmologic descriptions. However, I have been studying toxoplasmosis since 1935, on and off, and have had an opportunity to collaborate with many ophthalmologists during those years. Thus, I have come to appreciate the problems which they encounter when it is necessary to decide whether or not certain manifestations in patients are or are not due to toxoplasmosis. My present discussion, therefore, will deal chiefly with those problems in toxoplasmosis which are of special interest in ophthalmologic practice.

Let me begin by saying that according to the most critical evaluation of the present evidence, Toxoplasma occur in nature only in a limited number of animals. We have no evidence that they are widespread or even occur in paddybirds, sparrows, lizards, or all sorts of other living beings so often listed in the literature. I should say that those records in the literature are based on morphologic examinations without the experimental support which I believe to be necessary for initial identification of a given parasite as Toxoplasma. One must be able to prove that a morphologically similar parasite is capable of producing disease in a variety of experimental animals—mice, guinea pigs, rabbits, chick embryos, monkeys. Unless one can demonstrate this pathogenicity for many hosts, one cannot speak of the parasite as Toxoplasma. There are a number of other protozoan parasites, particularly the hemogregarines, which morphologically may simulate Toxoplasma in birds and other animals. I will give you my own present opinion regarding the natural reservoirs from which human beings may acquire Toxoplasma.

Foremost in this respect are the domestic animals, especially the dog and

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cat. There is good evidence to suggest that the Toxoplasma can come out in their feces and urine. Contamination of a person's hands, with subsequent transmission of the parasites to the mouth, can constitute at least one means of infection. In addition to the dog and cat, particularly on farms, one must also consider sheep, rabbits, guinea pigs, voles, and possibly squirrels. The evidence is now very good that pigeons are also carriers of Toxoplasma. Dr. H. A. Feldman, working in my laboratory in 1947, recovered Toxoplasma from a pigeon trapped in Cincinnati and showed for the first time the existence of natural infection in these birds in the United States. I should say that except for pigeons we have no adequate evidence at this time that any birds are carriers of this organism.

So much for the source of the infection in nature.

DIAGNOSIS

What can we say about what may be regarded at the present time as solid evidence relative to the pathogenic effects of Toxoplasma in human beings? Personally, I find it helpful to carry the following classification in mind.

First of all, I think separately of the pathogenic effects resulting from prenatal infection, namely, congenital toxoplasmosis. Secondly, and in a separate category, must be considered the type of pathologic effects that may be produced in human beings when the infection is acquired at any time after birth. The evidence is very good that when a pregnant woman becomes infected with Toxoplasma she exhibits either no clinical signs of infection or at least nothing that is clinically characteristic, while in the fetus and especially in the developing nervous system, of which the eye is only one part, the Toxoplasma, as a rule, produce especially severe lesions. There is unquestionably a tremendous difference in the susceptibility of the fully developed or postnatal central nervous system and the embryonic nervous system as regards the pathogenic effects of Toxoplasma. The effects of toxoplasmic infection in utero are now well founded on a number of careful postmortem studies. However, as regards the question of what happens when the Toxoplasma infect human beings after birth, the information is relatively meager. The best evidence that human beings can be infected with Toxoplasma without exhibiting any clinically recognizable manifestations is to be found among the mothers who give birth to children with proved congenital infections. However, a certain proportion of human beings—and we do not know what that proportion is at the present time—can develop clinical manifestations as a result of postnatal toxoplasmic infection. One of the manifestations which has definitely been proved—and I want to separate again the hypothetical from the proved—is encephalitis in children, which, although fatal in the one proved case, is not characterized by destruction of the nervous tissues, such as has been demonstrated in the congenital form. Another type found in adults has been a systemic infection, simulating some of the rickettsial diseases, with rash and pneumonitis. Here, also, the lesions in the central nervous system were minimal. To the best of my knowledge, there is as yet no pathologic evidence that ocular lesions occur as a result of postnatal toxoplasmic infection in man.

You all know that in the last six years the impression has spread that Toxoplasma may be the cause of chorioretinitis acquired after birth as well as prenatally. This diagnosis has been considered in individuals exhibiting chorioretinitis of unknown etiology who also had antibodies against Toxoplasma. The

presence of the antibodies has been regarded as presumptive evidence that the chorioretinitis was of toxoplasmic etiology. I should like to point out that that impression developed at a time when the serologic diagnostic tests for toxoplasmosis were as yet poorly developed and their significance not properly evaluated. It is only in the past 18 months that new and quantitative methods have been developed which make the serologic diagnosis of toxoplasmosis somewhat more certain.

Before describing and analyzing the recent methods and data, I should like to state that, in my opinion, there is at the present time no evidence that chorioretinitis can be a manifestation of toxoplasmic infection occurring at any time after birth of the individual. Furthermore, there is also no evidence that a healed chorioretinitis in an individual with an arrested congenital toxoplasmic infection can light up and become an acute chorioretinitis. I know that all that has been hypothesized, but, in my opinion, there is as yet no evidence that it occurs. I should like to stress that I did not say that acute chorioretinitis *cannot* occur in an adult as a result of toxoplasmic infection: I merely said that there is as yet no adequate evidence for it.

I should like to describe the methods that we now have at our disposal to determine whether this does or does not occur. I will not say anything at this point about absolute diagnosis on the basis of isolation of the organism by inoculation in experimental animals or demonstration of the organism in histologic sections, because the opportunity to establish the diagnosis by these methods presents itself almost exclusively in fatal cases. The problem that faces the ophthalmologist is how the diagnosis can be established in a patient who survives—and there is reason to believe that some individuals with the congenital disease may survive with residua which predominantly affect the eyes.

Up until about a year ago, we had one test with which many of you are familiar, that is, the neutralization test in the rabbit's skin. I hope you will forgive me if I go into the details of what these tests are about, because if some of you people are going to ask for serologic tests you ought to know what has to be done and what is being demonstrated. You should know that one cannot grow Toxoplasma in a simple culture medium the way one can grow ordinary bacteria or certain Protozoa. Toxoplasma multiply only in living, susceptible tissue; we must, therefore, use animals for all this work. In the rabbit neutralization test, we determine the capacity of human serum to inhibit or modify the skin lesions produced by Toxoplasma in the rabbit's skin. A diagram of such a test is shown in figure 1. The skin of a rabbit's back, from which the hair is clipped, is divided into a number of areas as indicated in the diagram. Toxoplasma, in different dilutions of infected mouse-brain suspension, are inoculated intracutaneously. Skin lesions, diminishing in size with increasing dilution, develop in four to seven days. When these varying dilutions of Toxoplasma-containing tissue suspension are mixed with human serums, some fail to modify the skin lesions, and these are said to be without antibody. Serums which modify the skin lesions only slightly have been regarded as yielding equivocal results of uncertain significance. The serums which completely inhibit some of the lesions and modify the size of the others have been regarded as being positive for toxoplasmic antibody.

However, there was something very peculiar about the antibody in human serum which produced these effects against Toxoplasma in rabbits. If you sent such a specimen of serum in the ordinary mail, the antitoxoplasmic effect

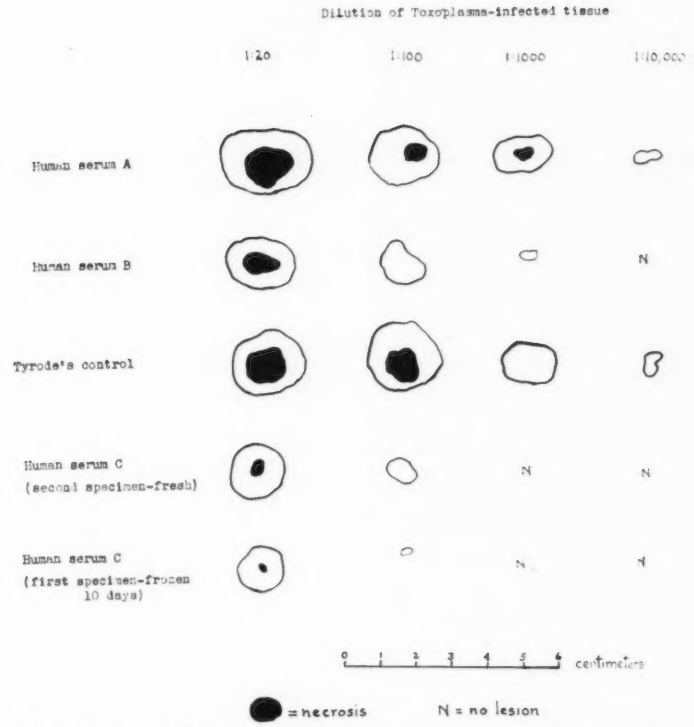

FIG. 1—Tracing of Toxoplasma neutralization test on back of rabbit, seven days after inoculation. (From Sabin, A. B.: Toxoplasmosis: recently recognized disease of human beings, Advances in Pediat., 1:1-56, 1942 [Interscience Publishers, New York].)

disappeared. If you left it at room temperature for a little while, the antibody effect disappeared and you could not revive it simply by adding some complement in the form of guinea pig serum. So, you will recall, it was always necessary to send serums for such tests in the frozen state, in dry ice. Another thing that was peculiar about this "antibody" effect was that, when one tried to dilute the serums even a little bit, this effect disappeared. We, therefore, thought that the antibody was readily destroyed at ordinary temperatures and that it was present only in very low concentration. Many human beings, without any history relative to Toxoplasma, yielded serums which had the same antitoxoplasmic properties, qualitatively and quantitatively, as, let us say, a child with congenital toxoplasmosis or its mother. So we had no way of differentiating between the toxoplasmic "antibody" in the serums of normal individuals and that found in the serum of a mother or a child who was definitely proved to be infected. We could not do very much with this type of antibody test, and it made no difference whether such serum-Toxoplasma mixtures were tested in the rabbit's skin, the chick embryo, or in mice. This type of test yielded only qualitative information. That was the main difficulty up until a very short time ago.

Now I should like to show you a new type of test (fig. 2) which has been

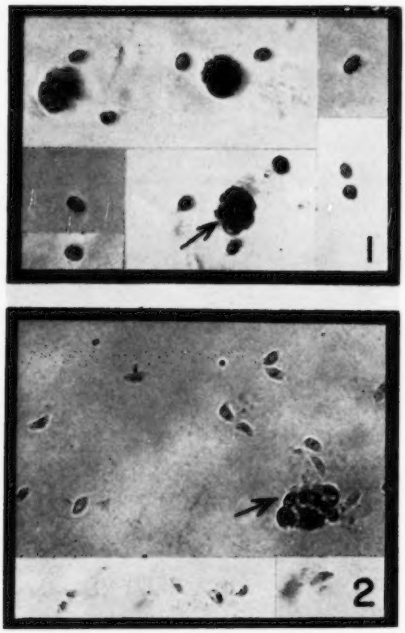

FIG. 2—(1) Toxoplasma incubated with *fresh normal serum* and then mixed with methylene blue. Note that the organisms are rounded or oval, the cytoplasm stains dark, and the lighter-staining chromatin body is surrounded by a light zone. Arrow points to a group of intracellular Toxoplasma. Different fields are presented because of difficulty of getting organisms into focus in wet preparation. (x650.) (2) Toxoplasma incubated with *fresh immune serum* and then mixed with methylene blue. Note that the organisms are mostly crescentic, the cytoplasm is unstained except in the intracellular group (arrow), and the chromatin remains stained. Wet preparation. (x650.) (From Sabin and Feldman,[3] p. 661.)

elaborated during the past 18 months. It depends on the discovery of an entirely new immunologic principle which has given us an opportunity to study the serologic reactions in this disease in a quantitative manner. In the upper part of the picture you see what happens when Toxoplasma, obtained from the peritoneal exudate of a mouse, are incubated with fresh, normal, human serum which contains *no* toxoplasmic antibody, and some alkaline methylene blue is added to it. Note the staining of the cytoplasm and the chromatin of the extracellular Toxoplasma, as well as of those inside the leukocytes.

However, when the Toxoplasma were mixed with the fresh serum of a mother who had given birth to a child with congenital toxoplasmosis (or the child's serum in which toxoplasmic antibodies were present), incubated in the same way for an hour and then tested with alkaline methylene blue as the indicator, we found that something very peculiar had happened to the cytoplasm. The cytoplasm of the Toxoplasma had now lost its affinity for the dye. The chromatin still stained the same way. However, that applied only to the organisms which were outside of cells; the intracellular organisms were protected from the action of the antibody and did not show this reaction. We found that the antibody which was responsible for this phenomenon was the same as the neutralizing antibody which we were testing before in rabbits, mice or chick embryos. However, the utilization of this phenomenon as the basis of a new quantitative, in vitro test for toxoplasmic antibody depended on still another discovery. That discovery was that the specific antibody was relatively heat stable, i.e., it was not destroyed by heating at 56 C. for 30 minutes or by being in the mails at summer temperatures for many days, but that by itself it could neither neutralize the pathogenic effects of Toxoplasma or modify the affinity of the cytoplasm for certain dyes. To achieve this another substance was necessary. That substance was very unstable at ordinary temperatures and was present in all human serums in such small amounts that even slight dilution, usually beyond 1:2, was sufficient to reduce it below the effective level. Thus, it became evident that the complete immune phenomenon depended on a heat-stable specific antibody plus a nonspecific, heat-labile factor related to but not identical with the ordinary complement. It also

became apparent that what was present in small amounts was the nonspecific accessory factor and that the specific antibody could be present in small or large amounts depending upon the history of the individual's experience with Toxoplasma.[3]

Now let me tell you how this was then used as the basis of the new, quantitative test, which is being called the "dye test" for toxoplasmic antibody. The serum from a suspected case, which can now be shipped without refrigeration, is used to prepare a number of dilutions in saline. To each of these dilutions is added a suspension of Toxoplasma (from the peritoneal exudate of a mouse) in fresh, undiluted, normal human serum which is free of toxoplasmic antibody but contains the important accessory factor. The normal human serum which is the source of the accessory factor can be stored frozen in dry ice and used when needed. After incubation of these mixtures in a water bath at 37 C. for one hour, small drops from each tube are mixed with the alkaline methylene blue, and the percentage of extracellular Toxoplasma whose cytoplasm remains unstained is determined. *The dye test titer refers to the highest original dilution of a serum which, in the presence of a constant, adequate amount of accessory factor, is capable of depriving the cytoplasm of 50 per cent of the Toxoplasma of its affinity for methylene blue at pH 11.0.* By this method it was possible to show that experimental animals and human beings with proved recent toxoplasmic infection yielded serums with dye test titers in the range of 1:1,000 to 1:16,000. Such serums in the old rabbit test could not be differentiated from "normal" human serums with toxoplasmic antibodies; however, the dye test titers of such "normal" human serums have rarely exceeded 1:64.

During this same period, an improved, quantitatively controlled complement fixation test has been developed utilizing ultracentrifuged extracts of Toxoplasma-infected chorioallantoic membranes of embryonated eggs as the antigen.[5] In experimental animals, we have found that the dye test antibody appears in three to five days after inoculation with Toxoplasma and reaches peak titers of 1:1,000 to 1:4,000 in 10 to 21 days, while the complement-fixing antibody appears later and can still be absent three to four weeks after infection. However, both of these antibodies have been found to persist in high titer for many months and years and it is, unfortunately, not possible to say that a high titer of either antibody is indicative of an active or persistent infection. The dissociation between the two types of antibody during the early stage of toxoplasmic infection may, perhaps, provide the only serologic means by which activity may be detected. Thus, if a serum had a high titer of dye test antibody (1:256 or more) with little or no complement-fixing antibody, the latter, however, increasing in titer subsequently, there would be a reasonable basis for suspecting an active infection during that particular interval of time.

Now I should like to discuss with you the results we obtained with the aid of these new diagnostic methods in a group of 43 children who exhibited chorioretinopathy associated with various other manifestations of cerebral damage. The question in all of these was whether the diagnosis was toxoplasmosis. The results[2] have recently been published.

It is evident from the results shown in table 1 that these children fell into two distinct groups — one serologically compatible with a diagnosis of *congenital* toxoplasmosis (because, in all instances, their mothers' serums also yielded the high antibody titers found in association with proved toxoplasmic in-

TABLE I

QUANTITATIVE TOXOPLASMA ANTIBODY TESTS ON CHILDREN EXHIBITING CHORIORETINOPATHY WITH OTHER SIGNS OF CEREBRAL DAMAGE AND ON THEIR MOTHERS

GROUP	TIME MONTHS AFTER BIRTH	CHILDREN			MOTHERS		
		NO.	DYE TEST TITERS	COMPLEMENT FIXING TITERS	NO.	DYE TEST TITERS	COMPLEMENT FIXING TITERS
Serologically compatible with congenital toxoplasmosis	0 - 5	4	4096, 1024 1024	0, 32, 32, 128	5	1024, 1024 4096, 1024 2048	32, 64, 32 32, (16), 32
	6 - 23	6	4096, 1024 1024, 1024 4096, 16384	32, 16, 2 32, 32, 128	6	1024, 4096 1024, 1024 1024, 256	16, 32, 4 16, 32, 4
	24 - 71	6	256, 1024 128, 1024 1024	64, 64, 128 8, 16, 16	6	256, 256 256, 256 32, 1024	64, 16, 64 8, 4, 16
	72 - 84	4	64, 64 16, 16	8, 16, 0, 2	2	128, 64	8, 32
Serologically *not* congenital toxoplasmosis	0 - 5	5	0,0,0,0,0	0,0,0,0	5	4,0,0,0,0	0,0,0
	6 - 23	14	Undil,0,0,0,0,0 0,0,0,0,0,0,0,0	0,0,0,0,0,0 0,0,0,0,0,0	14	4,4,4,16,16,<64 64,0,0,0,0,0,0,0	8,2,2,0,0,0 0,0,0,0,0,0
	67	1	0	0	1	0	0

(From Sabin and Feldman,[2] p. 298.)

fection), and the other without serologic evidence of toxoplasmosis. In the serologically positive children, aged up to 23 months, the dye test titers were all in the range of 1:1,024 to 1:16,384, and all but 2 of the 10 children in this group had complement-fixing antibody titers of 1:16 to 1:128. The 1 child, aged 5 weeks, whose serum gave a *completely negative* test for the complement-fixing antibody, nevertheless had a dye test titer of 1:4,096. You will recall my earlier remark that such dissociation of the two antibodies was found during the early stages of active infection in experimental animals, and it is important to note that this particular child died several days later with signs of active encephalomyelitis. The other child, with a complement-fixing titer of 1:2 and dye test titer of 1:1,024 at the age of 15 months, showed the same results in a specimen of serum taken at 30 months of age. This suggests to me that the complement-fixing antibody either may be very low in some patients or may disappear rather rapidly, and that, therefore, it is not advisable to rely on this test alone. The dye test and complement fixation test together give us more information than either one of them alone.

The results from the children over 2 years of age and from their mothers in the serologically positive group indicate that, while the toxoplasmic antibody titers can remain high for a number of years, there is a definite tendency for them to drop as the years go by. For this reason, after six to seven years it may be difficult to establish the diagnosis of congenital toxoplasmosis with certainty in the individual case. The data on the mothers in this group also provided us with evidence that high dye test and complement-fixing toxoplasmic antibody titers do not necessarily indicate persistent infection. Seven of the mothers with these high antibody titers gave birth subsequently to children who were normal and free of any evidence of congenital toxoplasmic infection. One can

say that in these mothers the toxoplasmic infection was either completely "burned out" or under sufficient control to prevent transmission to subsequent children.

In the serologically negative group of children, it is noteworthy that among the mothers' serums 40 per cent gave positive tests for toxoplasmic antibody by the dye test and 15 per cent by the complement fixation test. Notice, however, how low the titers are in this group by comparison with those found in the mothers whose children were also serologically positive. Actually, the mothers of the serologically negative children exhibit about what has been found in the population at large *in the same age group*. In former years, when one found a child with chorioretinopathy and certain other signs that might *appears to be no justification for considering the diagnosis of toxoplasmosis in the absence of conclusive serologic data.* The assumption, previously entertained, that the toxoplasmic antibodies may disappear quickly in some individuals or that infants may be slow in developing their own upon losing the placentally transmitted maternal antibody is now without valid evidence and, therefore, untenable.

Our studies[4] on placental transmission of toxoplasmic antibody indicate that when the child is *not* infected the antibody has either entirely disappeared or dropped to a negligible titer by the end of four months. This must be borne in mind in establishing the diagnosis in doubtful cases.

The most important conclusion from this study of 43 children is that there

TABLE II

INCIDENCE OF CEREBRAL CALCIFICATION AMONG CHILDREN EXHIBITING CHORIORETINOPATHY AND OTHER EVIDENCE OF CEREBRAL DAMAGE IN RELATION TO SEROLOGIC EVIDENCE OF CONGENITAL TOXOPLASMOSIS

SEROLOGIC EVIDENCE OF CONGENITAL TOXOPLASMOSIS	AGE GROUP YEARS	NO.	CEREBRAL CALCIFICATION PERCENTAGE POSITIVE
Positive	Under 2	13	92
	2 - 7	10	80
	Total	23	87
Negative	Under 2	19	5
	2 - 7	1	0
	Total	20	5

(From Sabin and Feldman,[2] p. 299.)

suggest congenital toxoplasmosis associated, however, with negative or equivocal tests for toxoplasmic antibody in the child's serum and positive results in the mother's serum—*by the rabbit method*—there was a tendency to interpret these as instances of congenital toxoplasmosis in which the child had failed to develop antibodies (and there are many such case reports in the pediatric and ophthalmologic literature). The serologic pattern obtained by the new quantitative methods is such that *now there* exists a syndrome, most probably congenital and of which chorioretinopathy is one manifestation, which clinically simulates healed congenital toxoplasmosis but which is not due to toxoplasmic infection. I can tell you that the 20 patients in the nontoxoplasmic group were accumulated in a much shorter time than the others, and it is my impression that this syndrome probably is more frequent than congenital toxoplasmosis.

A very interesting correlation with

reference to the incidence of cerebral calcification appeared when we analyzed the other clinical manifestations of these two groups of children with chorioretinopathy (table II). Among the 23 children with positive serologic evidence of toxoplasmosis, 87 per cent had cerebral calcification associated with the chorioretinopathy, while among the 20 children with negative tests for toxoplasmic antibody, only 5 per cent had cerebral calcification. I must say that in a few of the x-rays of the skull we had to look pretty hard to find the minute foci of calcification, but we looked just as hard in both groups. Thus, it may be possible to formulate the following useful *clinical guide* for the ophthalmologist. If the chorioretinopathy of presumable congenital origin is associated with cerebral calcification, the chances are approximately 9 to 1 that serologic tests will prove it to be due to congenital toxoplasmosis; on the other hand, if it is not associated with cerebral calcification, the chances are approximately 9 to 1 that it is *not* due to toxoplasmosis. I want to stress, however, that in the individual case the diagnosis must still be made by the serologic tests. It is important to do this not only for academic reasons but also because it permits the physician to tell the parents that the outlook for a subsequent normal child is good when the diagnosis of congenital toxoplasmosis can be confirmed. In the nontoxoplasmic group, where chorioretinopathy is associated with other evidence of cerebral damage, we still do not know enough

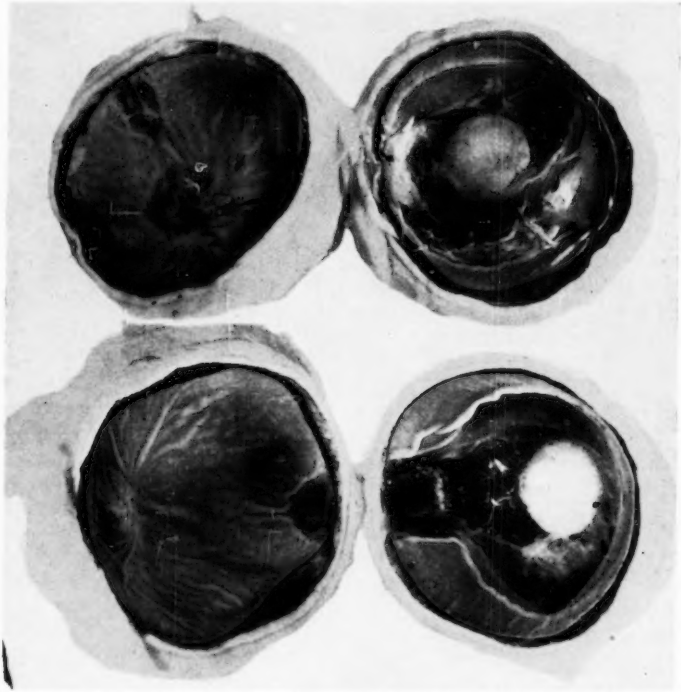

FIG. 3—Eyes of a child (R. B.) with congenital toxoplasmosis, dead at 8½ years of age. Photographed after fixation in Verhoeff's solution (formalin, alcohol, and picric acid).

about familial and other underlying factors to be able to say anything.

Now I should like to show you certain pathologic manifestations which have been encountered post mortem in patients with nontoxoplasmic congenital chorioretinopathy. For comparison, however, I should first like to show the eyes of a child with congenital toxoplasmosis who died at 8½ years of age. I observed this child from the time it was about 6 months of age when the diagnosis was first established by serologic methods. Note (fig. 3) the "punched-out" lesions in the macular region and elsewhere in the retina of one eye, and the single lesion in the retina of the other eye. Histologic examination of these lesions revealed only scar tissue and very scanty infiltration with mononuclear cells. No Toxoplasma were found anywhere in the eyes or brain, which showed extensive destruction with hydrocephalus and bone formation in the calcified areas. However, even at 6 months of age, brain tissue obtained by cortical biopsy revealed no Toxoplasma by histologic examination or animal inoculation. This may be taken as an example of a congenital toxoplasmic infection which was "burned-out" very early in life.

It is my present impression that in the group of children with chorioretinopathy and other evidence of cerebral damage but without cerebral calcification and not associated with toxoplasmic infection, we are dealing with lesions which most likely represent defective development rather than healed, inflammatory foci. The first patient belonging to this group that we have had an opportunity to study post mortem (at 1 year of age) fits this hypothesis very well. In figure 4, you see the eyes of this patient—one with microphthalmus and microcornea and the other normal in size. During life, fundoscopic ex-

FIG. 4—Eyes of child (Lo.) with nontoxoplasmic chorioretinopathy and associated cerebral damage—dead at 1 year of age.

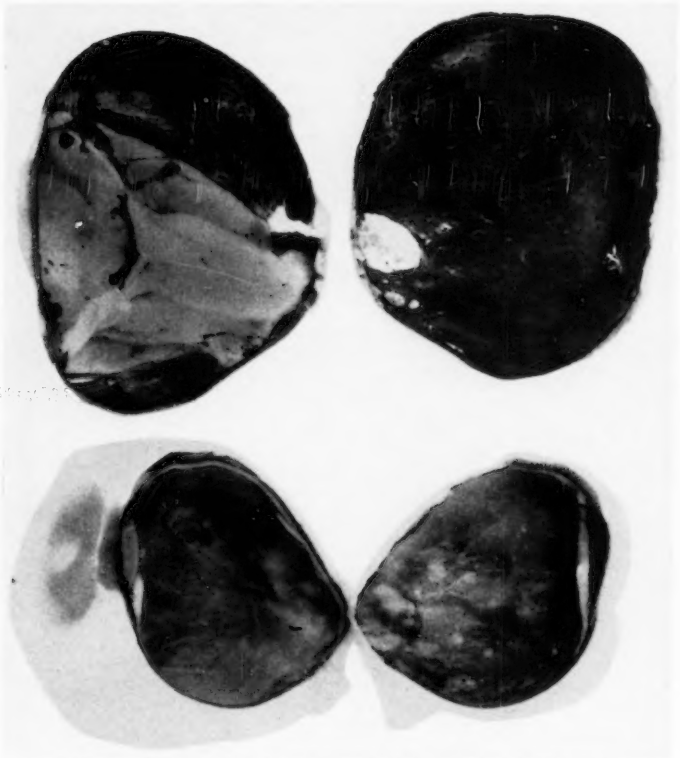

FIG. 5.—Same as figure 4. Photographed after fixation in formalin.

amination of the microphthalmic eye was impossible, while in the other eye a lesion was found in the macular area which was described as an "old, healed chorioretinitis." On section (fig. 5), the microphthalmic eye showed a retrolental mass, extending from the lens to the disk, apparently enveloped by the detached retina. Microscopically the mass consisted of fibrovascular tissue with retinal elements scattered irregularly through it. Of particular interest was the fact that the retinal tissue and pigment was found for a considerable distance within the optic nerve. In the other eye, one can see grossly the lesions in the macular area and elsewhere in the retina, which were apparent on ophthalmoscopic examination. Microscopically, this eye showed evidence of defective development rather than scarring with inflammatory reaction; in some areas the normal retinal tissue was missing with pigment showing through and in others very little pigment was present. In this eye, also, extensive retinal rests were found within the optic nerve. Defective development was also evident in the brain of this child—it was smaller than normal, there were many microgyri, the posterior horns of the lateral ventricles were open, and many cysts were found in the choroid plexus. There was no evidence of any inflammatory or destructive process and no calcification.

In addition to this noninflammatory, defective development type of syndrome, I have recently come across another condition in infants characterized by chorioretinopathy, hydrocephalus with extensive destruction of brain tissue, cerebral calcification, and psychomotor disturbances, *but* unassociated with any evidence of toxoplasmic or other infection. The first instance of this condition I studied through the courtesy of Drs. Gilbert J. Levy and W. W. Tribby of Memphis, Tenn. The eye lesions, which during life were described as "healed chorioretinitis," presented neither destructive nor inflammatory changes and consisted of retinal and choroid atrophy. The brain, however, presented extensive destructive, noninflammatory lesions associated with extensive calcification and, in the softened areas, peculiar degenerative changes in many of the small blood vessels. These vascular lesions consisted of an eccentric thickening of the walls filled with hyaline or amorphous, granular or fibrillar, acidophilic material staining a deep purple with phosphotungstic acid hematoxylin. Shortly thereafter, through the courtesy of Drs. R. V. Platou and John Dent of New Orleans, I saw postmortem material with similar vascular lesions in an infant who also exhibited chorioretinopathy, cerebral calcification and hydrocephalus, but without lesions suggestive of toxoplasmic or other infection.

So much for the differential diagnosis of chorioretinopathy which is seen in early childhood, which may be assumed to be of congenital origin. The main thing to remember is that some are caused by Toxoplasma and others not, and the only way to be certain in the individual patient is by use of the quantitative methods recently described. When "healed" chorioretinopathy is first discovered in school-age children, the possibility of its being a healed, congenital toxoplasmic lesion can be entertained when the serums of *both* the mother and the child contain toxoplasmic antibodies, even of low titer, because the incidence of such antibodies in normal children under 15 years of age is probably less than 10 per cent. It should be realized, however, that in the individual case such positive serologic evidence constitutes high probability but *not* proof that the eye lesion is due to toxoplasmosis. Since after 15 years of age the incidence of toxoplasmic antibodies in the normal population begins to rise very abruptly, it becomes increasingly more difficult to correlate chorioretinitis of unknown etiology in adults with *mere presence* of such antibodies.

Since it has been maintained in several recent publications that the incidence of positive skin reactions to Toxoplasma antigen is very much higher in adults with chorioretinitis of unknown etiology than in others and since this has been offered as evidence of the toxoplasmic etiology of the chorioretinitis, I should like to discuss the present status of the significance of this skin test in patients. The skin test with Toxoplasma antigen (called toxoplasmin by Frenkel) in human beings is considered positive when a delayed, tuberculin-type reaction appears. Dr. H. A. Feldman and I[1] have used extracts of Toxoplasma-infected chorioallantoic membranes, and of normal membranes of embryonated eggs for control, to study the reactions obtained in the "normal" population of different ages in the Cincinnati area. With at least 20 individuals in each age group, we obtained the following results: none positive in the 0 to 4 year group, 5 per cent positive in years 5 to 9, 14 per cent in years 10 to 19, 20 per cent in years 20 to 29, 50 per cent in years 30 to 39, 65 per cent in years 40 to 49, and 65 per cent in years 50 to 81. But what does a positive or negative skin test mean as an indicator of toxo-

plasmic antibody? We found that all people who gave a positive skin test also had antibody in their serum by the new dye test. However, those who had a titer of 1:4 gave just as strong a skin reaction as those with a serum titer of 1:4,000. Furthermore, the reverse did not obtain: a considerable proportion of normal people, and also some with proved toxoplasmic infection, who gave negative skin tests had antibody of varying titer in their serum. I regard the skin test as being of no value for diagnostic purposes because a negative test does not indicate absence of antibody or infection, and a positive skin test does not differentiate between individuals having a titer of such dubious significance as 1:4 and those with the highly significant titers of 1:256 or more. The skin test may, nevertheless, be used as a crude tool for population surveys and group correlation studies, provided such studies are properly controlled as to "normal" antigen, age grouping, and place of birth or residence.

Why such a large proportion of the *adult* population has antibodies for Toxoplasma is not at the present time altogether clear. Undoubtedly in some instances this is due to inapparent or unrecognized infection with Toxoplasma, but we cannot as yet be certain that in other instances, particularly in the very low titer group, this may not be due to infection with an as yet unknown agent possessing a common antigen with Toxoplasma. For this reason, I believe that not until it can be shown that acute uveitis and chorioretinitis *of the noncongenital variety* are associated with the high titers of antibody found in proved instances of inapparent or clinically recognized toxoplasmic infection will it be possible to assign an etiologic role to this parasite in this condition. The few patients in this category whom I have had an opportunity to study thus far yielded only the low titers found in the normal population at a time when the ophthalmologist considered the ocular condition as relatively acute. If a patient with acute chorioretinitis exhibited shortly after onset a dye test titer of 1:256 or more and a negative result or low titer in the complement fixation test which, however, rose very appreciably several weeks later, there would be valid serologic evidence for considering a toxoplasmic etiology in such a case. But, let me add, this has not as yet been demonstrated.

THERAPY

I was also requested to say something about specific therapy. Although various drugs have been found capable of killing Toxoplasma in vitro, they were without effect in vivo. The sulfonamides, which are without effect on Toxoplasma in vitro, are the only ones thus far shown to exert a distinct therapeutic effect in experimental animals. A typical experiment in mice is presented in table III. This shows that 1 per cent sulfathiazole in the diet completely held the infection in check, even when 10,000 minimal lethal doses were inoculated directly in the brain, for as long as the drug was being consumed and for a considerable time thereafter. It should be noted, however, that about 50 per cent of the mice ultimately died of toxoplasmosis when the drug was discontinued. Another type of experiment, in which the effect of delaying sulfathiazole therapy in mice is studied (table IV), indicates that with a dose of Toxoplasma which kills all untreated animals in 7 to 10 days, a delay of two days reduces the percentage cured from 78 to 56, and a delay of four days reduces the ultimate effectiveness of the drug to zero. It is noteworthy that it is easier to cure rabbits than mice, apparently because treated rabbits develop immunity while the mice do not.*

*Since this paper was presented, Summers reported that aureomycin also is an effective therapeutic agent against Toxoplasma in mice. (Summers, W. A.: The effects of oral administration of aureomycin, sulfathiazole, sulfamerazine and 4, 4'-diamino diphenyl sulfone on toxoplasmosis in mice, Am. J. Trop. Med., 29:889-893 [Nov.] 1949.)

TABLE III

EFFECT OF SULFATHIAZOLE IN DIET ON TOXOPLASMIC INFECTION BY INTRACEREBRAL ROUTE IN MICE

DILUTION OF TOXOPLASMA-INFECTED BRAIN SUSPENSION	CONTROLS NO DRUG IN DIET	1% SULFATHIAZOLE IN DIET FOR 21 DAYS AFTER INTRACEREBRAL INJECTION OF TOXOPLASMA	
		MICE DYING WHILE ON DRUG	MICE DYING AFTER REMOVING DRUG
10^{-1}	4, 5, 5*	0, 0, 0	0, 0, *33*
10^{-2}	6, 6, 6	0, 0, 0	*36, 46, 51*
10^{-3}	6, 6, 7	0, 0, 0	0, *54, 54*
10^{-4}	7, 7, 7	0, 0, 0	0, 0, *46*
10^{-5}	8, 9, 0	0, 0, 0	0, 0, 0

*—Numerals refer to day of death of inoculated mouse.

0—Mouse remained well.

Numerals in italics indicate mice which died of toxoplasmic infection after discontinuance of drug; numbers refer to days after inoculation.

(From Sabin, A. B. and Warren, J.: Therapeutic effectiveness of certain sulfonamides on infection by an intracellular protozoon (Toxoplasma), Proc. Soc. Exper. Biol. & Med., 51:22, 1942.)

Is there any point at all in administering sulfonamides to an infant with congenital toxoplasmosis? I see none. The lesion and the damage that has been done are, as a rule, already so far advanced that I do not think anything whatever can be gained. Is there any point in administering sulfonamides to an individual with an acute chorioretinitis which may possibly be due to toxoplasmosis? I would say that when the day comes when such a diagnosis can be entertained with assurance—then, yes; but that day has not yet come, and the existence of noncongenital, acute toxoplasmic chorioretinitis still has to be demonstrated.

Let me consider still another possibility which applies not to ophthalmologists but to obstetricians. Some obstetricians have begun to study women in the prenatal clinic to see whether or not they can pick up an acute toxoplasmic infection during the course of the pregnancy. I would say that if an obstetrician finds a woman who has a very high titer of dye test antibody and no complement-fixing antibody, there is a good possibility that she is undergoing an acute infection with this organism and, in such a case, I think, yes, there is an indication for giving sulfonamides in the hope of preventing a congenital toxoplasmosis.

I understand that some ophthalmologists, on the suggestion of Dr. Frenkel, have been administering Toxoplasma antigen to patients exhibiting acute chorioretinitis or a hypothetic acute exacerbation of a chronic retinitis. In my opinion, there is at present no adequate evidence that there is such a thing as an acute exacerbation of a congenital toxoplasmic chorioretinitis and, as was pointed out before, no evidence that noncongenital acute chorioretinitis is caused by Toxoplasma. Furthermore, even if there were, I cannot see what the administration of small amounts of Toxoplasma antigen can possibly do to such a lesion.

I have one message that I should like to leave with my ophthalmologic colleagues and that is—make a study with the new serologic methods of those cases of acute chorioretinitis in children and adults which are of unknown etiology to determine whether or not and

TABLE IV

EFFECT OF DELAYING SULFATHIAZOLE THERAPY ON TOXOPLASMIC INFECTION IN MICE

TIME AFTER INFECTION 1% SULFATHIAZOLE DIET BEGUN	TOTAL TIME ON DIET, DAYS	NO. OF MICE	% OF MICE SURVIVING ONE MONTH	% OF MICE CURED	DAY OF DEATH OF SUCCUMBING MICE
Immediately	23	9	100	78	*37, 37*
2 days	28	9	67	56	8, 14, 20, *42*
4 days	26	19	47	0	8, 8, 8, 9, 11 12, 13, 13, 13, 21 *40, 40, 40, 42 42, 42, 42, 42, 44*
5 days	Duration of experiment	10	0	0	6, 6, 6, 8, 8 8, 8, 11, 11, 15
6 days	"	10	0	0	7, 7, 8, 8, 8 8, 8, 8, 8, 8
6 days 2 mg. t.i.d. by stomach tube on 6th day + diet	"	10	10	0	7, 7, 7, 7, 7 7, 8, 8, 8, *46**
Untreated controls	—	20	0	0	7, 7, 7, 7, 8 8, 8, 8, 8, 8 8, 8, 8, 8, 8 8, 9, 9, 9, 10

Legends as in table III.

* This mouse was on the sulfathiazole diet for *22* days.

All mice were inoculated intraäbdominally with 0.3 cc. of a 1:100 suspension of Toxoplasma-infected brain —about 100 M.L.D.

(From Sabin, A. B. and Warren, J.: Therapeutic effectiveness of certain sulfonamides on infection by an intracellular protozoon (Toxoplasma), Proc. Soc. Exper. Biol. & Med., 51:21, 1942.)

to what extent toxoplasmosis may be involved. For the present, however, the ophthalmologist has good reason to consider toxoplasmosis only in the differential diagnosis of chorioretinopathy of congenital origin.

REFERENCES

1. Feldman, H. A. and Sabin, A. B.: Skin reactions to Toxoplasma antigen in people of different ages without known history of infection, J. Clin. Investigation, 28:780 (July) 1949; Pediatrics, 4:798-804 (Dec.) 1949.

2. Sabin, A. B. and Feldman, H. A.: Chorioretinopathy associated with other evidence of cerebral damage in childhood: a syndrome of unknown etiology separable from congenital toxoplasmosis, J. Pediat., 35:296-309 (Sept.) 1949.

3. ———: Dyes as microchemical indicators of a new immunity phenomenon affecting a protozoon parasite (Toxoplasma), Science, 108:660-663 (Dec. 10) 1948.

4. ———: Persistence of placentally transmitted toxoplasmic antibodies in normal children in relation to diagnosis of congenital toxoplasmosis, Pediatrics, 4:660-664 (Nov.) 1949.

5. Sabin, A. B.: Complement fixation test in toxoplasmosis and persistence of the antibody in human beings, Pediatrics, 4:443-453 (Oct.) 1949.

QUESTIONS AND ANSWERS

(Questions submitted from the floor were directed by Dr. Frank B. Walsh to the symposium speaker whose particular subject encompassed the field in question.)

DR. WALSH: We shall be glad to have any questions written by members of the audience sent up so that I may distribute them to Dr. Hogan and Dr. Sabin. I am very happy to take all the prerogatives of my office and answer only questions which I feel reasonably capable of answering correctly.

Concerning calcification there are two questions that have come to hand and the percentage of occurrence has already been stated by Dr. Sabin. The first question is, when does the calcification appear? The calcification is frequently present when the infant with congenital toxoplasmosis is born and it has been found in stillborn children that have toxoplasmosis.

Does the calcification change or increase? We have had at least one case in which it seemed to be incontrovertible that the calcification did increase in amount.

The next question concerns the occurrence of calcification in retrolental fibroplasia. I pointed out that retrolental fibroplasia might be confused with toxoplasmosis, and I was greatly interested in a comment by Dr. Reese that Dr. Raymond Pfeiffer has discovered calcification in a case of retrolental fibroplasia. I pointed out to Dr. Reese, however, that it would be quite possible for an infant to have both retrolental fibroplasia and toxoplasmosis.

I have some questions now directed to Dr. Sabin. The first question is, do domestic animals that are infected with toxoplasmosis show signs of the disease?

DR. SABIN: Cats have been observed with convulsions, depression and respiratory signs due to pneumonia. Dogs have exhibited diarrhea, wasting, respiratory signs, jaundice—clinical signs suggesting distemper, leptospirosis, or a foreign body in the respiratory tract. Post mortem, in addition to specific lesions in the lungs, liver, pancreas and lymph nodes, ulcers have been found in the intestines, which were lined with Toxoplasma. When you look at such sections, you can see how Toxoplasma can appear in the feces of dogs and subsequently find their way into the mouths of human beings. In Denmark, M. Christiansen (Medlemsblad for den Danske Dyrlaegeforening, vol. 31, 1948) reported that in autopsies on 2411 hares which died spontaneously 8.75 per cent showed signs of toxoplasmosis, and that on the island of Bornholm it was 28.8 per cent. The lesions were distributed throughout the body, including the liver, suggesting a systemic disease.

It is also possible that some animals may show no clinical signs of the disease, because in experimental work on dogs we found that inoculated puppies became sick and died while older dogs showed no signs of illness even though they had the infection. We were able to demonstrate Toxoplasma in the urine of experimentally infected dogs.

DR. WALSH: Dr. Sabin, the next question is, Is there any evidence of survival of the parasite in pseudocysts or are these pseudocysts entirely hypothetical in toxoplasmosis?

DR. SABIN: There is very good evidence that Toxoplasma survive in so-called pseudocysts in animals. Early in our investigations, we had a strain of Toxoplasma of guinea-pig origin that was not very virulent for mice, and many mice survived experimental infection by it. When we killed such mice months later when they appeared perfectly healthy, we could find "pseudocysts" in their brains. When we ground up such brains and injected the suspensions into new mice, the new mice became infected and frequently died—showing that Toxoplasma in the pseudocysts were still infectious, although not in the host from which they were derived. A pseudocyst, incidentally, is nothing more than an infected cell whose cystoplasm has been almost completely occupied by Toxoplasma and its nucleus apparently extruded. There is, however, no adequate evidence that such pseudocysts persist for many years in human beings or, if they do, that they can break down and cause any appreciable local reaction. The pseudocysts found in animals are also invariably without associated inflammatory reaction.

DR. WALSH: Is there any information on the incidence of a positive dye test in the general population?

DR. SABIN: The incidence of the positive dye test in the general population runs close to the data that I gave you on the skin test, with the exception that many individuals over 20 years of age with negative skin tests yield serums with positive dye tests. The incidence rises abruptly after 20 years of age, when approximately 30 per cent of the population may have antibodies against Toxoplasma, and as the groups tested get further along in years the incidence may rise to as high as 80 per cent. A recent survey with the dye test was made in Stockholm, Sweden, and Dr. Gard found an even higher incidence of positive results there in the older age groups than we found in Cincinnati. But I should like to stress once again that the important thing with the dye test is not whether it is positive or negative but what the titer is. The significance of any given titer must be interpreted in the light of the principles I have just discussed.

DR. WALSH: Dr. Sabin, how early prenatally may calcium be seen roentgenologically in these patients?

DR. SABIN: Dr. Walsh has already pointed out that calcification has been found in the stillborn. I don't know just how early such calcification may occur in an infected fetus. Pathologists tell us that in the presence of necrotic tissue one may get calcium deposition within a few weeks. Unpublished work by Professors Gard and Magnusson, which I have just seen in Sweden, would suggest that when the infection of the fetus takes place during the first few months of pregnancy there may be an abortion. They have proved that in Stockholm by demonstrating Toxoplasma in the uterine scrapings of such a patient. They are now engaged in a study to determine the role of toxoplasmosis as a cause for spontaneous abortion of unknown etiology.

DR. WALSH: The next questions are for Dr. Hogan, and I am afraid, Dr. Hogan, that they are rather all-embracing. Is there in your opinion anything sufficiently specific about the ophthalmologic picture taken as a single finding that would do more than merely to suggest the possibility of toxoplasmosis, and what other conditions do you consider are most likely to be confused with the ophthalmoscopic picture of toxoplasmosis?

DR. HOGAN: As I stated in my paper, some authors state that the chorioretinal lesions of toxoplasmosis are characteristic and diagnostic, but most people feel that there is no specific lesion in the fundus which is diagnostic of chorioretinitis. The fundus lesions that have been demonstrated in children who died of toxoplasmosis may be macular or extramacular, and Dr. Sabin has already given us several examples of lesions which may be confused with those of toxoplasmosis. Congenital anomalies of the choroid and retina may simulate these lesions.

DR. WALSH: Again using my prerogative, I would say that, in addition to having learned a great deal, this has seemingly a sound basis as a conclusion:

Dr. Sabin has clearly shown how difficult it is to make the diagnosis of toxoplasmosis, yet I feel very heartened by his statement that, if there is chorioretinitis and calcification, the probability is 9 to 1 that the diagnosis is congenital toxoplasmosis. It seems to me that if we bear this in mind our accuracy in diagnosis will be considerably higher than under most other conditions because we rarely obtain 90 per cent accuracy.

Finally, I would only say that I am sure that all of you down there and those of us up here are exceedingly grateful to Dr. Sabin for his most enlightening talk.

THE USE OF ANTIBIOTICS AND SULFONES IN CLINICAL OCULAR TUBERCULOSIS

A Preliminary Report

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THE experimental background for the use of both streptomycin and promizole in ocular tuberculosis has been presented in papers X, XI, and XII of "Studies in Experimental Ocular Tuberculosis."[5,6,7] It was first pointed out (study X)[5] that promizole had a deterrent action on the course of ocular tuberculosis in the immune-allergic rabbit. This effect became evident after the third week of treatment. There were, however, both clinical and histologic evidences of active disease in the eyes of these treated animals, although much less than in the controls. In the next study (XI)[6] it was shown that the deterrent action in the normal rabbit, where there was no immunity and the test was therefore much more severe, was much less than in the immune-allergic animal. In study XII[7] the therapeutic actions of streptomycin and the combination of streptomycin and promizole in the immune-allergic rabbit with ocular tuberculosis were reported. Streptomycin alone had a markedly deterrent action on the disease; nevertheless, minimal histologic evidences of active tuberculosis remained in the eyes of the treated animals. The combination of streptomycin and promizole, however, produced a most dramatic therapeutic result. The eyes of all treated rabbits were free of any clinical evidence of activity after four weeks of treatment, and showed only scarring or the persistence of a few wandering cells on histologic examination. There was only one relapse in the animals kept for observation after cessation of treatment. Cultures of the uveal tracts of six animals showed only one with tubercle bacilli, and on transmission experiments uveal tracts of 50 per cent of the treated animals were noninfectious, while the uveal tracts of all the untreated controls showed positive cultures and were infectious. It was concluded that the combination of streptomycin and promizole had a therapeutic action much greater than could be expected by mere summation and that this effect probably was due to a synergistic action — the two agents attacking either separate phases of the metabolism of the mycobacterium tuberculosis or different mutants of the organisms. In the most recent study (XIII),[8] it was shown that this combination of streptomycin and promizole had an equally favorable therapeutic effect in the normal rabbit, indicating that they acted entirely independent of immunity and quite probably had a direct bacteriocidal effect on the bacilli.

With the demonstration of the dramatic therapeutic action of these agents in experimental ocular tuberculosis and their relative lack of toxicity in animals the next step was to apply this form of therapy to ocular tuberculosis in humans and to evaluate its therapeutic activity.

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CHOICE OF PATIENTS

In the application of any form of supposedly specific therapy to ocular tuberculosis, one is always beset with the uncertain nature of the diagnosis. In the absence of tissue for biopsy and material for animal inoculation or from which the bacilli may be isolated, the diagnosis must perforce be presumptive. Therefore, in the evaluation of any new form of therapy the diagnostic criteria should be unusually rigid.

There were two guiding principles on the choice of patients to be treated. The first principle was that the diagnosis of ocular tuberculosis in any treated patient must be so firm that it would meet the approval of any experienced ophthalmologist. The following diagnostic criteria were observed: (1) the ocular disease must conform to a pattern commonly regarded as tuberculous, and in which histologic examination of eyes with similar disease patterns had uniformly demonstrated the probable toberculous nature of the disease; (2) the patient must show elsewhere in the body some evidences of a preceding tuberculous infection, a source from which the ocular infection might logically have arisen; (3) the cutaneous reactions to tuberculin must be in conformity to the patient's age and tuberculous status; (4) the most thorough and exhaustive medical survey possible should reveal no other systemic disease or cause to which the ocular inflammation could logically be attributed. The details of this diagnostic survey have been outlined elsewhere.[4] The second guiding principle in the selection of patients was that the ocular disease either had not yielded to more conventional forms of therapy or did not appear amenable to such therapy, and that the condition of the patient was sufficiently desperate to warrant any risk this treatment might entail.

Thirteen of the 14 patients whose cases are reported here filled the above criteria. In 1 case (10) the decision to treat the patient was borderline. While the clinical picture was highly suggestive and the diagnostic survey revealed no probable cause other than tuberculosis, the patient's reactions to tuberculin were almost negative and the only evidence of previous systemic infection was a calcified nodule in the lower lung field. This patient was treated only after consultation with the referring physician on the premise that the diagnosis was more than usually presumptive.

The 14 cases treated with streptomycin and promizole may be grouped as follows: 3 cases of generalized uveitis, 1 with a concomitant scleritis; 4 cases of classic sclerokeratitis, all with an anterior scleritis and marked corneal involvement; 1 case of diffuse scleritis, both anterior and posterior with proptosis and limitation of movement of the eye; 4 cases of marked exudative choroiditis, all with some involvement of the anterior ocular segment with mutton-fat keratic deposits and Koeppe nodules; and 2 cases of hemorrhagic retinitis or Eales's disease. As already stated, all cases except one appeared to be tuberculous beyond shadow of any reasonable doubt, and there was little probability any ophthalmologist would have made any other diagnosis in her case.

EVALUATION OF RESULTS

In the evaluation of results, it must be remembered that each observation of a therapeutic response is entirely uncontrolled. In the experimental disease, for each treated rabbit there is a control rabbit of similar breed, inoculated in a precisely similar manner and maintained under identical conditions. In such controls the course of the untreated disease can be carefully followed, evaluated, and compared to the

course of the disease in the treated animal. At the end of treatment, tissue is available for histologic examination, culture, and transmission experiments. In the human subject no such controls are possible. The judgment of the observing physician that the individual patient under treatment did better than would have been expected in the natural course of events and the summation of such judgments for a number of patients is the only method of assaying the value of the therapeutic agents. Thus the value of any observation is directly proportional to the individual ophthalmologist's knowledge of, and experience with, ocular tuberculosis. This, of course, introduces the human equation.

There is a known tendency of ocular tuberculosis to undergo exacerbations and remissions, which results in a second difficulty, that of attributing an improvement to the action of the therapeutic agent. Here again, it is largely a matter of study and opinion, although the time relation between clinical improvement and the administration of the therapeutic agents may clearly indicate a cause and effect relationship. In the cases here reported, the time of the onset of any improvement in relation to the beginning of therapy and the continuity of improvement was carefully considered.

A third difficulty is that a careful distinction must be made between reversible and irreversible changes in the eye. All any therapeutic agent can do is to destroy or immobilize the causative organism of the disease. If the disease is still in the infiltrative stage and tissue destruction or permanent inhibition of nutrition has not occurred, the destruction or fixation of the causative agent will be followed by a return of function. However, if irreversible changes have already taken place, little or no improvement in function can be expected. In the eye such irreversible changes would be: corneal scars; organic adhesions with their destructive sequelae; interference with the nutrition of the lens with resultant incipient cataract which may reasonably be expected to progress to maturity even though the underlying disease is controlled; heavy vitreous opacities, which may shrink over a long period but are nevertheless more or less permanent; the actual destruction of the percipient elements of the retina with secondary gliosis. Therefore, at the beginning of therapy, such organic changes would be carefully noted and estimated, and their persistence, after termination of therapy and the control of all inflammatory manifestations of the disease, should not be regarded as evidence of the failure of the therapeutic agent.

ADMINISTRATION OF THERAPEUTIC AGENTS

The proper dosage and methods of administration of new agents are largely matters of clinical observation. Fortunately, with both streptomycin and promizole, considerable accurate information was already at hand. The report of the Veterans Administration to the Council of Pharmacy and Chemistry of the American Medical Association,[1,2] showed that in man the therapeutic effects obtained when streptomycin was given in doses of 0.5 gm. every 12 hours were equal to those obtained when similar doses were given every six hours or oftener. Further, with this dosage the toxic effects were considerably less, involvement of the vestibular branch of the eighth nerve occurring in only 17 per cent of people so treated, whereas it occurred in 96 per cent of people receiving 2.0 gm. or more a day. This finding of similar therapeutic response to smaller doses at greater intervals is also in conformity with Feldman's experimental results.[3]

As concerns promizole, it had been found that a satisfactory therapeutic response was achieved in experimental animals with blood levels of from 1.5 to 2.0 mg. per hundred cubic centimeters and this had also been confirmed in cases of human systemic tuberculosis similarly treated. Blood levels of this magnitude are readily obtained in man by the administration of 6 gm. of promizole per day in divided doses. In the light of this information these dosages were adopted for the treatment of ocular tuberculosis in the patients here reported, i.e., 0.5 gm. streptomycin intramuscularly every 12 hours, and 6.0 gm. promizole orally in divided doses. With this dosage, the promizole level of plasma varied from 1.2 to 2.5 mg. per hundred cubic centimeters. Since these amounts gave a minimum of toxic reactions combined with an eminently satisfactory therapeutic response, they were in general given to all patients with two exceptions (cases 12 and 13). The newer dihydrostreptomycin hydrochloride was used in the last 7 patients treated, with an equally favorable therapeutic response. In passing, it may be noted that recent unpublished reports do not indicate a lessened toxicity of this preparation but rather a deferred toxic action. It is, however, worthy of note that 1 patient in this series (case 8), who had previously abandoned streptomycin on account of evidences of vestibular irritation, was later able to take the hydrochloride without any toxic symptoms.

In the first patient treated, streptomycin was first used alone, and promizole was added only two weeks before cessation of the streptomycin. This patient was treated before the synergistic action of the two agents had been demonstrated and this therapy was instituted with the idea that the promizole would be continued after a full course of treatment with streptomycin (120 gm.). In the second patient, promizole alone was used for a period of seven months and streptomycin added only when the patient had an exacerbation. In all other patients, streptomycin and promizole were given synchronously, and the combination was continued until what was considered a "full course" had been given or the occurrence of toxic symptoms indicated that one or the other agent should be withdrawn.

The proper total dosages of streptomycin and promizole for ocular tuberculosis are still undetermined in both experimental animals and man. On the information gleaned from experimental observations and the published clinical reports on the amounts of streptomycin used in systemic human tuberculosis, it was first decided a "full course" of streptomycin for ocular tuberculosis in man would be somewhere between 120 and 200 gm. Inasmuch as definite clinical improvement was noticed after the administration of much smaller amounts and we were naturally fearful of vestibular damage on the prolonged use of streptomycin, it was then decided to cut the total dosage of streptomycin first to 65 gm. and later to 42 gm., if these amounts could be taken without toxic symptoms. Certainly satisfactory immediate clinical results were obtained with as little as 6 gm. of streptomycin combined with 156 gm. of promizole, but whether these results will be permanent or whether the patients will later show recurrences remains to be seen. For the present, until more information is available, it would appear that when streptomycin is given with promizole a total dosage of 42 gm. of streptomycin given in doses of 0.5 gm. twice daily would be sufficient in all but especially severe and resistant cases. As far as promizole is concerned, the drug is relatively nontoxic in doses of 6 gm. a day. When toxic symptoms appear, they are quite definite—fever, vertigo, anorexia, mal-

aise, leukopenia, dermatitis — and they disappear immediately on withdrawal of the drug. Therefore, if the drug is being well tolerated and there appears to be any clinical indication for its further use, there is little reason why it should not be continued after the course of streptomycin is completed. However, in cases here reported a total of 250 gm. appeared adequate, although many patients took far greater amounts. It might be noted that a red color in the urine is the rule in promizole-treated patients and should not be considered a toxic reaction.

RESULTS

The highlights of the cases treated and the therapeutic results are given in table I. Summaries of the case histories of the 14 individual patients follow this report.

Therapeutic Response

In all of the 14 cases here reported, there was a complete resolution of all inflammatory symptoms. In 1 case (12) the patient arbitrarily reduced the dose of streptomycin to 0.5 gm. once daily, and the symptoms did not completely clear on this dosage. However, when the dose was increased to 1.0 gm. a day, there was complete clearing in three weeks.

The first evidence of change for the better was observed from nine days to three weeks after beginning treatment, and the improvement steadily continued after cessation of treatment until the eyes showed no evidences of any activity. However, irreversible changes did not disappear, vitreous opacities remained although vitreous haze cleared and the opacities became more circumscribed (cases 2 and 8). In 3 patients (cases 1, 3, and 6) lenticular opacities already well advanced when treatment was started progressed steadily until the cataracts became mature. In cases 4 and 7, with heavily scarred corneas, there were no changes in vision although all evidences of inflammation disappeared. These may all be taken as instances of irreversible changes in the eye. In all the remaining cases, there was not only a complete clearing of all clinical evidences of active inflammation but also a considerable restoration of vision. The minimum improvement was from 3/200 to 12/200 in case 8 with irreversible vitreous opacities, while the maximum was from finger counting at 2 feet (60 cm.) to 20/20 (-1) in case 9. In this patient, the initial visual loss was due to early unorganized infiltrates in the cornea, a reversible change.

The conspicuous finding in relation to the therapeutic response was the uniform and apparently complete control of the clinical evidences of inflammation. In the limited period of observation after cessation of treatment, there have been no recurrences. The period of observation is, however, too short to justify any conclusions on this point. However, the indications, from the evidence at hand, are that these agents have a therapeutic action in human ocular tuberculosis quite comparable to their effect in experimental animals—certainly a bacteriostatic and probably a bactericidal effect.

Toxic Reactions

Streptomycin. All patients given streptomycin were warned of the possibility of vestibular symptoms and were instructed to stop the drug on the appearance of any vertigo. Patients under immediate control were examined each week by an otolaryngologist for any evidences of vestibular irritation, and each patient not under immediate control was instructed to have similar examinations made by his local specialist.

Four patients (1, 2, 3, and 7) receiving streptomycin developed evidences of vestibular irritation. One patient developed reactions to streptomycin but

TABLE I

Case	Age	Diagnosis	Duration and Amount of Treatment		Toxic Reaction		Results
			Streptomycin	Promizole	Streptomycin	Promizole	
1	55	Scleritis Uveitis	5 mos. 120 gm.	3½ mos. 676 gm.	+	+	Complete subsidence of all inflammation. Mature cataract.
2	48	Choroiditis	42 days 42 gm.	17 mos. 2250 gm.	+	None	Complete subsidence of choroiditis. Vision improved from 20/100 to 20/30+.
3	38	Uveitis	34 days 34 gm.	8 mos. 1410 gm.	+	None	Complete subsidence of all inflammation. Mature cataract.
4	55	Bilateral sclerokeratitis	30 days 42 gm.	16 days 98 gm.	None	+	Complete subsidence of inflammation. Vision rose from 1/200 to 8/200.
5	26	Choroiditis	6 weeks 80 gm.	6 weeks 300 gm.	None	None	Complete resolution of choroidal exudate. Vision rose from 10/200 to 20/30.
6	56	Uveitis	5 mos. 152 gm.	5 mos. 900 gm.	None	None	Complete subsidence of all inflammation. Mature cataract.
7	49	Bilateral sclerokeratitis	26 days 26 gm.	26 days 156 gm.	Slight	Slight	Subsidence of inflammation. No change in vision.
8	48	Choroiditis Uveitis	62 gm. 62 days	60 days 480 gm.	None	None	Subsidence of inflammatory symptoms. Vision rose from 3/200 to 12/200. Streptomycin in two courses.
9	61	Sclerokeratitis	65 days 65 gm.	31 days 180 gm.	None	+	Complete subsidence of all inflammation. Vision rose from counting fingers to 20/20 (−1).
10	24	Choroiditis	42 days 42 gm.	42 days 252 gm.	None	None	Presumptive diagnosis. Arrest of progression and subsidence of inflammatory symptoms. No change in vision.
11	24	Scleritis	40 days 40 gm.	70 days 402 gm.	None	None	Complete subsidence of all inflammation. Vision unchanged at 20/20.
12	24	Sclerokeratitis Uveitis	112 days 84 gm.	91 days 504 gm.	None	+	Regression of original lesions and improvement of vision from 20/100 to 20/40. One area of scleritis persisted after administration of 63 gm. but cleared completely after 84 gm.
13	37	Hemorrhagic retinitis	42 days 168 gm.	42 days 252 gm.	None	None	Absorption of hemorrhages. Right vision rose from 1/200 to 20/100. Left vision improved from 20/50 (−1) to 20/40.
14	31	Tuberculous periphlebitis of retina	42 days 42 gm.	42 days 252 gm.	None	None	Absorption of hemorrhages. Right vision rose from finger counting to 20/30. Left vision declined from 30/50 to finger counting and then improved to 6/200 at time of discharge.

later took dihydrostreptomycin without reaction. In every case the symptoms disappeared after the drug was withdrawn. There was no instance of any residual damage to the vestibular tract and no persisting aural symptoms. With the precautions of warning the patient, weekly aural examinations, and immediate withdrawal of the antibiotic on any evidences of vestibular irritation, there appears to be no significant danger in the use of streptomycin.

Promizole. Four patients (1, 4, 9, and 12) showed definite toxic reactions to promizole. Patient 1 took 600 gm. of promizole without reaction over a three and a half month period and then exhibited weakness and malaise. The icterus index was found to be 17.2. Promizole was discontinued and there was a prompt recovery. Two weeks later it was recommenced and the patient now took 76 gm. without symptoms. She then again complained of weakness and dizziness. The icterus index at this time was 12, and the Hanger flocculation test was positive. Promizole was then permanently discontinued with prompt recovery from all toxic symptoms. Patient 4 developed dermatitis which subsided when promizole was withdrawn and recurred when it was again given. Patient 9 was hospitalized in the Wilmer Institute during treatment. After receiving 140 gm. of promizole she developed an unexplained fever and a relative leukopenia. Promizole was stopped with a prompt disappearance of all symptoms. Fever and leukopenia recurred when promizole was again given after a week of rest. It was then permanently discontinued with prompt subsidence of the fever and rise in the white count to normal. Patient 12 developed a relative anemia and leukopenia after taking 500 gm., and the drug was permanently discontinued. One other patient (7) showed slight symptoms, consisting of lassitude, headache and anorexia, after taking 156 gm. of promizole. Symptoms promptly disappeared after withdrawal of the drug, which was not again given. The occurrence of toxic reactions to promizole did not appear to be related to any undue concentration of the drug, the maximum plasma level obtained being 2.8 mg. per hundred cubic centimeters.

All other patients took promizole without symptoms of any kind, and one patient (2) continues to take small daily doses as a precautionary measure and has now taken a total of over 2000 gm.

Relation of Toxic Symptoms to Total Dosage

Streptomycin. In no case was evidence of vestibular irritation noticed until a minimum total dosage of 26 gm. had been reached. Other total dosages for individuals showing toxic symptoms were 34 gm., 42 gm., and 120 gm. In all patients showing reactions, the clinical improvement preceded the occurrence of the toxic symptoms. Thus in patient 7, with the minimum dosage of 26 gm. combined with 156 gm. of promizole, an excellent therapeutic response had been obtained before any toxic symptoms appeared.

Promizole. The patients showing reactions to promizole received from 98 gm. to 600 gm. before any toxic symptoms were noted. In each of these patients there had already been a satisfactory response to the treatment, which continued after the drug was withdrawn.

The evidence so far amassed indicates that while toxic reactions occur in a large percentage of patients treated with streptomycin and promizole, in no instance so far observed have the symptoms been severe or followed by any permanent residua. Moreover, in all instances the toxic symptoms were delayed and did not occur until a satisfactory therapeutic response had been obtained. It would therefore appear that,

with proper precautions, the combined treatment with streptomycin and promizole is reasonably safe. Since toxic reactions appear to be delayed, a therapeutic response may be expected before any toxic manifestations occur.

COMMENT

The cases here reported represent my total personal experience with the treatment of clinical ocular tuberculosis with streptomycin and promizole up to July 27, 1949. The small number of cases treated is explained by the rigidity of the criteria for selection: that the primary diagnosis be almost unquestioned and that the case be of sufficient seriousness to justify treatment. The number of cases is admittedly too few and the period of post-treatment observation too short to permit valid conclusions. This must, therefore, be considered a preliminary report. However, the material at hand does indicate that the combination of streptomycin and promizole has a remarkable therapeutic effect in clinical ocular tuberculosis, that toxic reactions are frequent but are comparatively mild, and that there is a reasonable expectancy for a therapeutic response before any toxic reactions become manifest. In short, there appears to be sufficient evidence for a more widespread use of these agents in tuberculosis of the eye.

A more widespread use must of necessity be followed by some unfavorable reports. There is no evidence whatsoever that these preparations are of the slightest value in any forms of endogenous ocular disease other than those caused by the Mycobacterium tuberculosis. The difficulty in establishing a diagnosis of ocular tuberculosis has been mentioned here and explored at length elsewhere. Both the clinical and experimental forms of ocular tuberculosis mimic the changes produced by other granulomatous diseases—syphilis, brucellosis, sarcoid, virus diseases, fungi, etc.—to an amazing degree. Since it is virtually impossible to establish conclusively the diagnosis of ocular tuberculosis by clinical examination alone, the most thorough and exhaustive medical survey is necessary to confirm the clinical impression. Even with such a complete survey, the final diagnosis is often somewhat uncertain. Therefore, it naturally follows that, if these agents obtain any widespread use by ophthalmologists, there is the probability they may be used for the treatment of other than tuberculous ocular disease. If the disease fails to respond to treatment, the failure will probably be attributed to the ineffectiveness of the therapeutic agents although it may in truth be the result of an incorrect original diagnosis. The meager evidence at hand indicates that the absence of a therapeutic response to these agents in supposed ocular tuberculosis might argue against the tuberculous nature of the disease, just as failure to respond to arsphenamine or penicillin argues against a syphilitic etiology. However, the available evidence for absolute specificity in ocular tuberculosis is still too slight to warrant such a sweeping assumption. Further, it has been demonstrated that some strains of the Mycobacterium tuberculosis are naturally resistant to streptomycin. At present, the wisest course would be to limit the use of these preparations to frank or probable cases of ocular tuberculosis and to refrain from using them in cases of doubtful etiology. Only by this means can a respectable body of evidence for or against their efficacy be accumulated. All that can be said at this time is that streptomycin and promizole have a proved and remarkable therapeutic effect in experimental ocular tuberculosis in both the immune-allergic and the normal animal, and that the meager evidence at hand indicates a no less dramatic effect in human cases.

CONCLUSIONS

1. Streptomycin given in doses of 0.5 gm. twice daily combined with promizole in the amount of 6 gm. per day in divided doses, had a dramatic effect in controlling the clinical evidence of activity and inflammation in the 14 cases of frank ocular tuberculosis so treated.

2. A therapeutic response was observed after 9 to 21 days treatment. The response thereafter was slow but steady.

3. Irreversible changes—corneal scarring, cataracts, vitreous opacities, and organic tissue damage—were not influenced by such treatment. Reversible changes — corneal infiltrates, iris nodules, choroidal exudates, and all inflammatory changes—regressed.

4. Toxic symptoms appeared in a large percentage of cases so treated. These symptoms were not serious and, when the drugs were discontinued, promptly disappeared without residua.

5. A therapeutic response was manifest before the appearance of any toxic manifestations.

CASE REPORTS

The individual protocols of the 14 cases may be briefly summarized as follows:

Case 1 (J.H.H. 350290) (referred by Dr. Charles Young)—A 50 year old white woman was first seen in May 1945. The family history was noncontributory and the past history was negative except for a mastectomy in 1933. On admission she showed a generalized granulomatous uveitis and scleritis in the right eye, the left eye being normal. The medical survey at that time was essentially negative except for marked tuberculin hypersensitivity. She was placed on tuberculin therapy, but proved almost impossible to desensitize on account of systemic and focal reactions. Her right eye went steadily downhill and in 1946 was enucleated as a blind, painful phthisical eye. Histologic examination showed a diffuse tuberculous uveitis. The left eye developed a uveitis and scleritis in 1946, and despite nonspecific treatment and what tuberculin could be tolerated, the disease progressed. In October 1947 there was advanced uveitis and scleritis with lenticular opacities and the prognosis appeared almost hopeless. Streptomycin was given over a five month period, the total dosage being 120 gm. It was discontinued on account of toxic symptoms. Promizole was started two weeks before cessation of streptomycin and was continued for three months, the total dosage being in the neighborhood of 600 gm. Toxic symptoms then developed and promizole was discontinued. However, while still on streptomycin, the eye began to clear, and improvement thereafter was steady until, in December 1948, there was no trace of inflammation. The lenticular opacities, present when first seen, progressed to a mature cataract, which was removed July 11, 1949.

Case 2 (referred by Dr. M. E. Randolph)—A 45 year old white physician was first seen in December 1947. The family history and past history were noncontributory. The right vision had begun to fail two months previously. Examination showed an extensive choroiditis on temporal fundus with definite evidences of involvement of anterior uvea. The left eye was negative. The medical survey was entirely negative except for radiographic evidences of an old extensive pulmonary tuberculosis. There was marked tuberculin hypersensitivity. The condition steadily progressed despite nonspecific protein therapy and local diathermy. Vision was reduced to 20/100. He was placed first on promizole alone and slowly improved for seven months, vision rising to 20/30. There was a sharp relapse after seven months treatment with promizole alone and streptomycin was then added. There was a prompt response after three weeks of treatment. The streptomycin was continued for 42 days and then abandoned on account of vestibular irritation. Promizole was continued on a reduced dosage of 4 gm. per day. By December 1948 the choroiditis was quiet, and on April 1, 1949, vision was 20/30+ and there were no evidences of any activity. The anterior uvea appeared entirely normal. Promizole is being continued as a precautionary measure. The total streptomycin dosage was 42 gm. and the total promizole dosage is now in excess of 2000 gm.

Case 3 (J.H.H. 235156)—A 30 year old white female was first seen in 1941 with an exudative choroiditis of the left eye. Medical survey showed evidences of old pulmonary tuberculosis and violent tuberculin hypersensitivity; otherwise it was completely negative. The initial attack of choroiditis quieted on tuberculin therapy, which was discontinued after

10 months but four years later was again given over an 8 months period for a recurrence in cutaneous sensitivity without ocular symptoms. There was a recurrence of choroiditis in January 1948. Tuberculin therapy was again recommended. She apparently received excessive doses and violent focal reactions ensued. She was seen again in March 1948. At that time there was a violent active generalized uveitis of the left eye with vision reduced to finger counting at 2 feet. The lens was opaque. Streptomycin and promizole were given. The streptomycin was continued for 34 days (34 gm.) and then discontinued on account of vestibular irritation. Promizole was continued for eight months, the total dosage being 1410 gm. There was a steady and complete subsidence of all inflammation. There was no improvement in vision, and on last examination in April 1949, the eye was white, free of all inflammation, tension was normal and there was a mature cataract. Vision was reduced to light perception and good projection. The right eye remained normal.

Case 4 (referred by Dr. Angus MacLean)—A 55 year old white female was first seen in May 1948. The family history and past medical history were noncontributory. The patient gave a history of recurrent bilateral sclerokeratitis since the age of 13 years. She had received tuberculin therapy over a 14 month period in 1943-1944 with some beneficial results. On examination the right eye was found to be inactive with old corneal scars, and the left eye showed a highly active sclerokeratitis in addition to old scars. Vision was reduced to 1/200. The survey was again entirely negative except for marked hypersensitivity to tuberculin and radiographic evidence of old, inactive pulmonary tuberculosis. Treatment with streptomycin and promizole was started June 2, 1948, and was continued for one month, the promizole being discontinued on account of a dermatitis, which cleared when promizole was withdrawn and recurred when it was again given. The total streptomycin dosage was 42 gm., and the total promizole dosage 98 gm. There was marked subjective improvement from the beginning of treatment; the examining ophthalmologist reported that monthly examinations showed marked clinical improvement, subsidence of inflammation and clearing of corneal infiltrates. By November, the eye was white and the disease inactive. Vision had risen to 8/200. The old corneal scars were unaffected.

Case 5 (referred by Dr. Angus MacLean)—A 26 year old white male was first seen in October 1948. The family had past medical histories which were noncontributory. Both eyes had been the site of repeated attacks of choroiditis in 1944 which had spared the macula. He received tuberculin for three years, from 1945 to 1947, but was able to take only low dosages. The left eye developed a small exudative choroidal lesion just nasal to the macula in April 1948, which cleared quickly leaving the eye with 20/15 vision. There was a recurrence in the left eye in August, which did not yield to nonspecific protein or tuberculin therapy. When examined in October the right eye showed scars of an old inactive choroiditis and 20/20 vision. The left eye showed atrophic scars from the former attacks and a large active exudate in the macula. Vision was reduced to 10/200 eccentrically. Medical survey was negative except for marked hypersensitivity to tuberculin and radiographic evidences of an inactive pulmonary lesion. Streptomycin and promizole were started on October 27 and continued until the patient received a total of 80 gm. of streptomycin and 300 gm. of promizole. Definite clinical improvement was noted two weeks after onset of treatment. The improvement steadily continued and at the end of the seventh week the choroidal infiltrates had subsided. On last examination the eye was free of all evidences of active disease, showing only old pigmented scars. Vision had risen to 20/30 from an initial low of 10/200.

Case 6 (J.H.H. 465463)—A 56 year old white female was first seen in June 1948. The family history and past history were noncontributory. She first developed visual symptoms in the left eye in November 1947. Examination in June 1948 showed the right eye normal throughout and a marked exudative choroiditis in the left eye, with Koeppe nodules, mutton-fat keratic deposits and mild evidences of anterior uveal involvement. Vision was reduced to hand movements. Posterior cortical opacities were noted in the lens. A complete medical survey was negative except for radiographic evidences of old pulmonary tuberculosis and a moderate (0.1 mg.) sensitivity to tuberculin, compatible with her age. She was placed on streptomycin and promizole on August 21, and this treatment was continued steadily except for a 12 day remission (November 23-December 5). On December 14, after 102 gm. streptomycin and 600 gm. of promizole, the inflammatory signs in the anterior uvea had completely disappeared. Treatment was continued up to Feb. 4, 1949, total streptomycin dosage being 152 gm., and total

promizole dosage, 900 gm. In February 1949, the eye was entirely quiet, there were no signs of any inflammatory reaction, but the cataract noticed on first examination had slowly matured. Vision was reduced to light perception and good projection.

Case 7 (J.H.H. 148260)—A 49 year old white woman had been under observation for a recurrent bilateral sclerokeratitis since 1931. The family history was noncontributory, and the past history was negative except for an old pulmonary lesion in girlhood and an eye history of recurrent bilateral sclerokeratitis since the age of 17. On first examination (1931) the right vision was 20/50 and the left vision 20/15. Both eyes showed marked peripheral corneal scarring and there was an active sclerokeratitis of the right eye. Medical survey was negative except for radiographic evidences of an inactive old pulmonary tuberculosis and marked tuberculin hypersensitivity. Brucella studies were all negative in 1931, but became positive in 1945, when the patient developed an unexplained intermittent fever. From 1931 to 1948, there were repeated attacks of sclerokeratitis in both eyes, especially the right. The patient received repeated courses of tuberculin, followed by ocular improvement, but complete tuberculin desensitization could never be attained. Local diathermy and nonspecific protein therapy had no effect on the ocular inflammation. There was some transient improvement under beta irradiation. In October 1947 a severe attack occurred in the right eye, which did not respond to any form of therapy. By August 1948, vision was reduced to light perception and the condition of the eye was so critical enucleation was considered. Streptomycin and promizole were started on August 10. Within two weeks there was a noticeable improvement, which steadily continued thereafter. All treatment was stopped on September 6 on account of mild vestibular irritation and mild toxic symptoms. The patient received a total of 26 gm. of streptomycin and 156 gm. of promizole. The improvement continued steadily after abandonment of treatment, and by October the eye was free of any active inflammation. There was no visual improvement on account of heavy corneal scarring. There have been no recurrences in a 10 month period of post-treatment observation. Degenerative calcareous deposits occurred in the cornea.

Case 8 (J.H.H. 485645) (referred by Dr. Arnold Knapp)—A 48 year old white female was first seen in December 1948. The family history was noncontributory. There was a past history of cervical adenitis as a child and a circumscribed choroidal lesion in the right eye 10 years previously, which healed under tuberculin therapy. The present illness began in August 1948 and consisted of severe recurrence of the choroiditis in the right eye with evidences of anterior uveal tract involvement. Penicillin and nonspecific protein therapy were given without avail. Streptomycin and promizole therapy had been given in New York over a 23 day period without apparent improvement and was discontinued on account of toxic symptoms. On examination in December there was extensive granulomatous uveitis of the right eye and vision was reduced to 3/200. No fundus details were visible on account of the vitreous clouding. The medical survey in New York and Baltimore was negative except for radiographic evidences of an old, inactive tuberculous lesion in the right outer lung field and marked hypersensitivity to tuberculin. Dihydrostreptomycin was now given with promizole, being started on Feb. 14, 1949, and continued for 62 days without toxic reaction. Treatment was followed at this time by a clearing of all signs of anterior inflammation, a relative clearing of the vitreous to the point that the fundus could be dimly seen, and an increase of vision to 12/200. A mild transient secondary glaucoma had developed. The total streptomycin dosage was 62 gm., and promizole, approximately 480 gm.

Case 9 (J.H.H. 490755)—A 61 year old colored female was first seen in February 1949. The family and past histories were noncontributory. The present illness was that of an inflammation of the right eye since August 1948. Examination showed a violent sclerokeratitis of the right eye with vision reduced to fingers at 2 feet. The medical survey showed an extensive, healed, calcified pulmonary tuberculosis and a violent hypersensitivity to tuberculin. All other examinations, including biopsy of a lymph node, were negative. Streptomycin and promizole were started February 21. Promizole was discontinued on March 22 on account of toxic symptoms (fever) but streptomycin was continued until April 25. The total dosage of streptomycin was 65 gm. and of promizole, 180 gm. The eye steadily improved, inflammation subsided, the keratic precipitates became crenated, the cornea cleared and vision rose to 20/40 at the time of discharge on April 25. On May 24 the eye was entirely inactive, free of all inflammation, vision was 20/20–1, and there was one small scar remaining in the cornea.

Case 10 (presumptive case) (referred by Dr. Julius M. Dan)—A 24 year old white female was first seen March 8, 1949. The family history was noncontributory. The only suggestive finding in the past history was a fistula-in-ano some years previously. Two months before she was first seen, the right eye developed a peripheral chorioretinitis which did not yield to penicillin therapy, local treatment, or general nonspecific therapy. Examination showed heavy vitreous opacities, some subretinal edema, but no areas of frank exudation. There were numerous Koeppe nodules and heavy mutton-fat keratic deposits. Vision was 20/50. The left eye showed keratic precipitates but had 20/20 vision and no lesions were present in the fundus. Medical survey was negative throughout except for the presence of a calcified nodule in the lower left lung field. The patient was relatively insensitive to tuberculin. A presumptive diagnosis of tuberculous choroiditis was made and the patient placed on dihydrostreptomycin and promizole as a therapeutic trial. This was continued over a 42 day period, the total streptomycin dosage being 42 gm., and the promizole dosage, 252 gm. On June 17, her referring ophthalmologist reported right vision of 20/50, left vision of 20/20. There were no evidences of any activity on ophthalmoscopic examination. The keratic precipitates either had been absorbed or were crenated. The vitreous opacities were unchanged. Her ophthalmologist summarized his findings as follows: "I definitely feel the treatment has helped. Her eye pathology was progressing up to the time treatment was started. There seems to be a halt to the advancing pathology."

Case 11 (J.H.H. 430175)—A 24 year old Negress was admitted to The Johns Hopkins Hospital on March 21, 1949, with a diagnosis of scleritis, left eye. The family and past histories were noncontributory. On examination the right eye was negative throughout. The left eye showed a diffuse purplish-red congestion involving all the visible anterior sclera. There was a relative proptosis of the eye and almost complete immobility. The aqueous ray was positive. Vision was 20/20. A diagnosis of deep scleritis, both anterior and posterior, with a secondary tenonitis, was made. The medical survey was essentially negative except for radiographic evidences of old pulmonary tuberculosis and moderate sensitivity to tuberculin. She was placed on streptomycin and promizole for a period of 40 days, and promizole was continued alone for a further period of 29 days. The total dosage was streptomycin 40 gm., promizole 402 gm. Marked improvement was noted after 14 days of treatment. At the end of three weeks the proptosis had disappeared and there was good motility. At the end of the sixth week there remained only a slight congestion of the sclera, and at the end of the tenth week there was a complete symptomatic cure, with subsidence of all evidences of scleritis and other inflammation.

Case 12 (J.H.H. 494912) (referred by Dr. Luther C. Brawner)—A 24 year old white female was first seen March 22, 1949. The family history was interesting. Her mother and father had died from tuberculosis and there was active tuberculosis in one brother. Her past medical history was essentially negative. She had suffered repeated attacks of sclerokeratitis in the right eye over a three year period. There had been intermittent tuberculin therapy for three years with no effect. The left eye had become inflamed one month prior to examination. Examination of her eyes showed some pericorneal inflammation of the right eye with five areas of deep infiltration in the cornea, and on ophthalmoscopic examination a small pigmented, atrophic lesion above the macula. Vision was 20/100. The left eye was quiet but showed a paracentral corneal infiltrate and three marginal infiltrates. Vision was 20/15. There were no keratic precipitates in either eye. The medical survey showed a violent hypersensitivity to tuberculin (0.001 mg.) and old tuberculous calcification in left lung and paratracheal area. Streptomycin and promizole were begun April 9. She received 1.0 gm. streptomycin daily for the first three weeks and thereafter only 0.5 gm. daily. By May 24 she had taken 32 gm. of streptomycin and 252 gm. promizole without reaction. Definite clinical improvement was noticed early in May. On May 24 there was a marked lessening of the inflammation, there being only a suggestion of congestion remaining, and the infiltrates were decidedly less. Vision had improved from 20/100 to 20/50. However, four posterior synechias had formed and there was a nodular-like mass in the iris stroma. Both streptomycin and promizole were therefore continued to July 6, making the total streptomycin dosage 84 gm., and promizole 504 gm. On July 6, the patient's physician reported that in the interim there had been some temporary vascularization of the cornea, which had regressed. Examination showed vision 20/50, the cornea was clear, except for interstitial scars, there were no keratic deposits, the aqueous ray was negative. The iris was free of inflammation;

there were no nodules. The posterior synechias were still present. There was, however, an area of scleritis at the extreme temporal sclera. Promizole was discontinued on account of a slight anemia and leukopenia. Streptomycin was continued, the dose being increased to 1.0 gm. per day. This treatment was continued for three weeks. On July 27 all evidences of activity had disappeared and vision had risen to 20/40.

Case 13—A 37 year old white male was first seen March 18, 1949. The family and past histories were negative. Retinal hemorrhages had developed in the right eye in 1942 and vision had been reduced in this eye since that date. Left eye was first affected in February 1949. Examination showed bilateral retinal hemorrhages with secondary gliosis and vision reduced to 1/200 in the right eye and 20/70 in the left eye. The medical survey, including lymph node biopsy, was entirely negative except for violent hypersensitivity to tuberculin (0.001 mg.) and calcified hilar nodes on x-ray examination. The patient was a veteran and was referred to the Veterans Hospital for streptomycin and promizole therapy, which was started on April 19. He was given an extremely large dose of streptomycin, 2 gm. twice daily and 6 gm. of promizole daily. Treatment was continued without toxic symptoms up to May 31. The total dosage was streptomycin 168 gm., promizole 252 gm. Examination on June 10 showed right vision of 20/100 and left vision of 20/100. The hemorrhage had entirely disappeared. Without further treatment of any kind, the vision on July 12 was right 20/100 and left 20/40. The right fundus showed a mass of glial tissue extending from the disk and involving the fovea. The left fundus showed a discrete mass of glial tissue between the disk and the fovea with some secondary granular degeneration of the fovea. There were no hemorrhages in either fundus and no suggestion of any activity.

Case 14—A 31 year old male Negro was admitted to the hospital on June 2, 1949, with a history of loss of vision of three weeks duration. The family and past histories were noncontributory. On examination, right vision was shown to be reduced to counting of fingers, and left vision was 20/50. Results of external and slit lamp examination of the eyes were negative. Ophthalmoscopic examination showed retinal and vitreous hemorrhages in both eyes with areas of retinitis proliferans and glial bands extending up into the vitreous. Quite evidently the eyes had been the site of repeated hemorrhages for some time, despite the history of onset three weeks previously. The medical survey was completely negative except for marked hypersensitivity to tuberculin and radiographic evidences of an old thickened pleura at the right base. All blood studies were negative. The patient was started on streptomycin and promizole on June 8, which was continued for 42 days to July 20. There were repeated hemorrhages in the left eye for the first three weeks and vision declined from 20/50 to finger counting. Thereafter there were no fresh hemorrhages, the vitreous cleared steadily in both eyes, and the old retinal hemorrhages partially absorbed. On July 9, the vision had risen to, right, 12/200 and, left, 8/200. On his discharge on July 20, there was no evidence of any hemorrhage, and glial bands were unchanged. Vision had risen to 20/30 in the right eye and 6/200 in the left eye.

REFERENCES

1. Dosages of streptomycin in tuberculosis, Current Comment, 133:842 (Nov. 29) 1947.
2. The effect of streptomycin on tuberculosis in man: report to the Council on Pharmacy and Chemistry, J.A.M.A., 135:634-641 (Nov. 8) 1947.
3. Feldman, W. H., Hinshaw, H. C. and Karlson, A. G.: Frequency of administration of streptomycin: its influence on results of treatment of tuberculosis in guinea pigs, Am. Rev. Tuberc., 55:435-443 (May) 1947.
4. Woods, A. C.: Endogenous Uveitis: Classification—Etiologic Diagnosis—Treatment. A manual prepared for the use of graduates in medicine by the American Academy of Ophthalmology and Otolaryngology, 1949.
5. Woods, A. C. and Burky, E. L.: Studies in experimental ocular tuberculosis: X. The effect of "promin" and "promizole" in experimental ocular tuberculosis in the immune-allergic rabbit, Arch. Ophth., 39:471-490 (April) 1948.
6. ———: Studies in experimental ocular tuberculosis: XI. Effect of "promin" and "promizole" in experimental ocular tuberculosis in the normal rabbit, Arch. Ophth., 40:1-13 (July) 1948.
7. Woods, A. C. and Wood, R. M.: Studies in experimental ocular tuberculosis: XII. Effect of streptomycin and "promizole" on experimental ocular tuberculosis in the immune-allergic rabbit, Arch. Ophth., 40:413-432 (Oct.) 1948.

8. ———: Studies in experimental ocular tuberculosis: XIII. Effect of streptomycin and promizole on experimental ocular tuberculosis in the normal rabbit. Unpublished data

DISCUSSION

JOHN G. BELLOWS, M.D., Chicago, Ill.: Like most ophthalmologists, I have been following with great interest the excellent series of papers by Dr. Woods on the pathogenesis and, more recently, on the therapy of experimental ocular tuberculosis. I was, therefore, extremely pleased to receive, in advance of this meeting, a copy of the first clinical paper in this series. Today's presentation firmly establishes Dr. Woods as the leading investigator in the field of ocular tuberculosis.

Too much emphasis cannot be placed on the importance of making an accurate diagnosis. It is difficult, or practically impossible, to make an absolute diagnosis because the prime diagnostic tool, namely removal of tissue for laboratory examination, is usually not available to us. However, by making use of Dr. Woods' criteria, a highly probable, if not absolute, diagnosis can be made.

From Dr. Woods' report, it appears that streptomycin-promizole therapy is effective both in fresh and old cases of ocular tuberculosis. This is in contrast to the relative ineffectiveness of streptomycin in chronic pulmonary tuberculosis. This difference in therapeutic response can be largely attributed to one factor; that is, the size of the lesion. It is obvious that in the eye, a tuberculous lesion and its accompanying caseation and fibrosis can never attain the size it does in the lung. Because of this relative difference in extent, the penetration of drugs into an ocular lesion is greater than into a pulmonary lesion, and consequently a higher concentration of the drugs can be achieved in the former.

Another favorable factor in the chemotherapy of ocular tuberculosis is that a small lesion in the eye produces conspicuous symptoms allowing early recognition and treatment.

It must be emphasized that the effect of streptomycin in vivo is bacteriostatic, that it does not destroy all the organisms but merely suppresses their development and growth. It is the vital resistance of the patient that finally eradicates the germs.

In other forms of tuberculosis treated with streptomycin, recurrences have taken place long after all clinical signs of inflammation have subsided. It may be possible that, because of the relatively small size of the lesion in the eye, the infection is more readily eradicated. However, since it is difficult to determine clinically whether or not the lesion is inactive, only time will tell whether a complete cure is obtained by chemotherapy in ocular tuberculosis.

Our experience differs from Dr. Woods' in that we have found no naturally occurring resistant strains of Mycobacterium tuberculosis. However, resistance may develop very rapidly. In vitro, a sensitive organism may develop resistance to streptomycin within 24 hours.

Since we are dealing with a chronic disease, the subject of resistance to streptomycin becomes important. With increasing dependence on streptomycin for clinical control of systemic tuberculosis, more and more ocular tuberculosis will be caused by streptomycin-resistant organisms. Fortunately, however, if the concentration of streptomycin is markedly increased, even resistant organisms will be affected. This, however, brings up the danger of streptomycin toxicity. Dr. Woods is to be commended for obtaining these excellent results without a single instance of permanent vestibular damage. In our experience, complete recovery does not occur after symptoms of vestibular damage appear. However, compensation does occur; complete compensation in children and young adults, incomplete compensation in older individuals. If streptomycin therapy is continued until severe damage ensues, then compensation is incomplete in all age groups.

Since the administration of streptomycin is required for relatively long periods of time in tuberculosis, toxicity is ever present. For this reason, streptomycin should never be employed as a therapeutic test in place of the more painstaking and difficult methods of diagnosis. Moreover, agents are available which are superior to streptomycin for certain infections of the eye that clinically resemble tuberculosis; for example, penicillin for syphilis and aureomycin for lymphogranuloma, venereum ophthalmitis or brucellosis. Further, the average case of ocular tuberculosis should be given a trial of conservative therapy and only when this fails and the disease is progressing should streptomycin-promizole be employed.

It is possible that other combinations of drugs may prove superior to the streptomycin-promizole combination for ocular tuberculosis.

Experimentally and clinically, it has been found that the combination of streptomycin with para-aminosalicylic acid is superior to any other combination for pulmonary tuberculosis. Para-aminosalicylic acid, in contrast to promizole or promin, is practically nontoxic when administered in the recommended dosage of 12 to 20 gm. daily. The chief complaint arising from para-aminosalicylic acid is heartburn, and this is readily relieved by sodium bicarbonate. Para-aminosalicylic acid has another important advantage over promizole in that it retards the emergence of organisms resistant to streptomycin. I should like to ask Dr. Woods if he has employed para-aminosalicylic acid with streptomycin in ocular tuberculosis. Also, I should like to know whether it is advisable to continue with tuberculin desensitization during this treatment.

I wish to express my thanks for the opportunity given me to discuss this most excellent paper by Dr. Woods.

DR. WOODS: Several very interesting points were brought up by Dr. Bellows with which I am in full agreement. First, as to the combination of this treatment with other more conventional forms, when we realize that the pathogenesis of the tuberculous lesion is governed by the number and virulence of the infecting bacteria and the degree of tissue hypersensitivity and that it is modified by the amount of systemic resistance or immunity, there are three methods of attack on tuberculosis.

The first is enhancement of immunity, which can unfortunately only be approached through general hygienic control. Trudeau's statement in 1893 that the production of an artificially-produced immunity to tuberculosis was an ideal which would probably never be attained is, unfortunately, as true now as it was then. While we have had some encouraging results from the mass inoculation of children with the BCG vaccine, nevertheless there is no method of producing an artificial immunity to tuberculosis. Therefore, we have to accept the fact that general hygienic control—proper diet, sunshine, rest, etc.—is the first cornerstone of treatment. The second cornerstone of treatment is the removal of the fatal tissue allergy which is responsible for the destructive phases of tuberculous lesions, and most certainly in hypersensitive individuals, when there are signs of any inflammation in the eye, tuberculin should be given and continued. There is no contraindication to the use of this together with specific therapy.

The third method of treatment is the direct attack on the tubercule bacillus. I agree thoroughly with Dr. Bellows that the essence of healing of tuberculosis is bacteriostasis. In some cases undoubtedly the bacilli may be destroyed or phagocytized by the phagocytic cells of the body; nevertheless, the essence of clinical cure is immobilization and preventing propagation of the bacilli by a bacteriostatic action.

Dr. Bellows brought up the very interesting question of the resistance of Mycobacterium tuberculosis to streptomycin. I have not worked on this phase. The strain of tubercle bacilli used for the production of experimental lesions is a virulent human organism which we have now used for a number of years and it has never developed a resistance to streptomycin. For that reason I have continued with the same strain. It is quite possible, indeed quite probable, that many strains may develop a resistance. In fact, my impression is that Dr. Feldman, in whose laboratory at the Mayo Clinic this subject has been most extensively investigated, has found several strains of Mycobacterium tuberculosis which are resistant to streptomycin. That is something we must also bear in mind

Dr. Bellows spoke of the fact that the vestibular damage might well be permanent, and the apparent clearing up of symptoms may be only a compensatory reaction on the part of the patient. This may well be true. I am not an otolaryngologist and can only report the advice of my otolaryngologic friends—that these 4 patients, after the development of the vestibular symptoms and cessation of the drug, had no visible or clinically manifest residual damage. It may, of course, have been a compensatory reaction.

Dr. Bellows brought up the most interesting question of the use of other antibiotics and other agents. It is quite true that other better antibiotics will be developed and that better accessory agents will be developed to augment the action of the antibiotic. In this respect he brought up the very interesting work that has been done with para-aminosalicylic acid, and he stated that he believed, combined with streptomycin, it would have a greater therapeutic effect than promizole. That well may be, and within the next three months I hope to be able to report comparative studies. But, peculiarly enough, while there have been a number of studies of the action of streptomycin and para-aminosalicylic acid together, no one has ever run a comparative set of animals with proper controls, one set treated with para-amino-

salicylic acid and streptomycin and the other set treated wtih promizole and streptomycin, so that we may have an estimate of the comparative value of these two different forms of treatment, both designed for the same end. This identical experiment is now under way, and I hope within the next three to six months to give an answer. At the present time my feeling is that streptomycin and promizole is the best combination we have, although it may well be that the combination of streptomycin and PASA will prove superior.

Lastly, Dr. Bellows mentioned the question of the dihydrosalt. This is really a very pertinent question. When the dihydrosalt was introduced it was supposed to give vastly less vestibular irritation than the usual streptomycin, and in this series there was one patient who had developed toxic reaction due to streptomycin and for whom streptomycin was discontinued. Because of the severity of the progressing ocular lesion, streptomycin was given again and this time the dihydrosalt was used and taken without reaction. There are recent unpublished investigations which indicate that the dihydrosalt will produce similar adverse action on the vestibular apparatus but that it is a delayed action. While the reaction with streptomycin comes on much sooner, the reaction with dihydrosalt comes on much later and appears to be equally severe. I personally have had no information on this myself and can only report to you what other investigators are apparently finding.

UNUSUAL TUMORS OBSTRUCTING THE LOWER RESPIRATORY TRACT OF INFANTS AND CHILDREN

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RESPIRATORY obstruction in infants and children is usually due to inflammatory disease. In rare instances, neoplasms in the airway may be an underlying cause. In this paper 8 cases of unusual tumors causing respiratory obstruction in infants and children are presented. The lower respiratory tract is considered to include the pharynx, larynx, trachea, and the main bronchi. Tumors obstructing these areas are usually slow-growing, but often acute obstruction is precipitated by a respiratory infection, the infection obscuring the underlying neoplastic process. The obstruction may be due to an intraluminal growth or to compression of the airway by a tumor arising from structures surrounding the airway. Only neoplastic growths are included in this series; such lesions as cysts and inflammatory tumors causing respiratory obstruction are not considered here. Papilloma of the larynx is not discussed in this paper although papilloma of the larynx is the most common neoplasm causing respiratory obstruction in infants and children.

CASE REPORTS

Case 1. R.B. This white male infant was first admitted to The Children's Memorial Hospital on Jan. 7, 1945, at the age of 5 weeks. Five days prior to his admission he suddenly developed episodes of cough, cyanosis, and dyspnea which recurred at two- or three-hour intervals. In the two days before admission he received sulfadiazine and oxygen as needed. Physical examination revealed the infant breathing rapidly and with marked retraction of the thoracic cage; he had periods of cyanosis, and a distinct systolic murmur was heard over the precordium. Routine laboratory studies of blood and urine gave normal findings; serology was negative. Roentgenograms of the chest showed the mediastinal shadow to be wide. It was felt that the patient had congenital heart disease but that this was not causing his present distressing respiratory symptoms. The following day a laryngoscopic examination revealed only slight thickening of the laryngeal structures; the airway through the larynx seemed adequate although the larynx was flaccid and had the characteristic appearance of congenital laryngeal stridor. The child received 414 r in air in two doses to the thymus region on January 8 and January 17 because of the wide mediastinal shadow. Episodes of respiratory obstruction gradually decreased in severity, although during one attack on the third hospital day the child became apneic and adrenalin and oxygen were given. Upon aspirating the pharynx at this time some of the formula was returned in the aspirator and the breathing improved.

On the eleventh day of hospitalization a laryngoscopic and bronchoscopic examination showed the left side of the larynx to be somewhat compressed. Breathing was easy and quiet with the bronchoscope in place. Because of the steady improvement that had occurred during the hospitalization, tracheotomy was postponed. The patient was discharged with a diagnosis of congenital heart disease and tracheal compression of unknown etiology.

He was readmitted to The Children's Memorial Hospital four months later. He had had a tracheotomy performed during the in-

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terval and appeared to be well in other respects except for a slight purulent discharge from the left eye. He had received treatment for a hemangioma on the posterior surface of the neck (200 kv. 18 ma. 5x5 port, ½ mm. copper, 1 mm. aluminum at 54 cm. 200 r x 6). A specimen of tissue exposed during the tracheotomy operation was interpreted as "sarcoma," and the case was thought to be hopeless. However, review of these microscopic sections was interpreted by one of us (D.P.S.) as showing a cellular hemangioendothelioma which was encapsulated, noninvasive and benign. The solid cellular portion of the tumor was thought not to be radiosensitive and, therefore, surgical excision was considered to be feasible and the treatment of choice. A left Horner's syndrome was noted consisting of miosis, ptosis and minimal enopthalmos. A laryngoscopic examination revealed further laryngeal and tracheal compression from the left. A palpable tumor was found in the left side of the neck, and exploration of the left side of the neck was advised. A barium esophagram was normal.

On June 1 surgical exploration of the tumor was carried out (D.P.S. and P.H.H.) through a curved incision with a lateral arm made along the border of the sternocleidomastoid muscle. An encapsulated, firm, bluish tumor which measured 4.5 by 2 by 1 cm. was found to lie medial to the common carotid in juxtaposition to and compressing the larynx, trachea and esophagus. This mass was removed, and further exploration revealed a similar mass farther posteriorly which was removed from the back of the neck. A complete neck dissection was done, leaving the carotid and vagus on the left side. A pencil-shaped mass, which obviously was composed of the same type of tumor tissue, was found lying behind the carotid. This was removed, and histologic examination showed it to be the cervical sympathetic chain surrounded by the tumor; this, of course, explained the preoperative Horner's syndrome.

Histologic examination showed the tumor to be a benign cellular hemangioendothelioma (fig. 1, A).

One week postoperatively the child was breathing well, eating, and retaining his food. On September 9 he was readmitted for reevaluation and possible decannulation. It was noted that the tumor was recurring in the midline of the neck and posteriorly in the left posterolateral cervical region. Roentgen radiation through two ports was given according to these specifications: 1 left posterolateral port and 1 posterior midline at 200 kv. ½ copper filter using 200 rx5 to each field. Gradual resolution of the tumor was noted, but efforts to decannulate the infant were unsuccessful until April 1946. At present the child breathes satisfactorily and the neck swelling has disappeared. The Horner's syndrome is still present. The heart is entirely normal, and the systolic murmur heard on the first admission has disappeared.

The final diagnosis is that the tumor is a cellular hemangioendothelioma, encapsulated and not invasive. The original interpretation of the biopsy was that the tumor was a sarcoma and there was considerable debate regarding its operability. It was felt that the tumor was not radiosensitive and, therefore, the radical surgical exploration in a child of this age was undertaken. However, a more critical evaluation has indicated that this was a benign lesion requiring resection because of its extent.

Final diagnosis: Benign cellular hemangioendothelioma of the left side of the neck compressing the larynx and trachea.

Case 2. V.H. This 14 week old white female infant entered The Children's Memorial Hospital on Dec. 14, 1947. In October she had developed acute laryngotracheobronchitis, on the sixth day of which a tracheotomy had been performed. Three weeks later the tracheotomy tube was removed but had to be reinserted three days later because dyspnea recurred. A laryngoscopy, which demonstrated a tumor in the left side of the larynx, was performed at this time. The child entered The Children's Memorial Hospital for study to determine the nature of this tumor. Except for the laryngeal obstruction the infant was normal, well developed and well nourished. Roentgenograms showed slight narrowing of the trachea above the tracheotomy tube. The Mantoux (1 to 1000) and the Kahn tests were both negative. The red blood cell count was 3,900,000; the white blood cell count, 13,000; and the differential count was within normal limits. The urine showed no sugar, albumin, or casts. Laryngoscopy and bronchoscopy demonstrated the obstruction to involve the left subglottic area. Granulations were seen around the tracheostoma, but there was no break in the mucosa over the mass in the larynx and it was felt that removal of tissue for biopsy might permanently injure the vocal cord. On Jan. 30, 1948, a needle was inserted into the mass seen immediately below the left cord. It appeared to be soft, rather than hard as would be expected of neoplastic tissue, but it was not fluctuant. Roentgenographic study of the esophagus with iodochlorol on March 2 showed

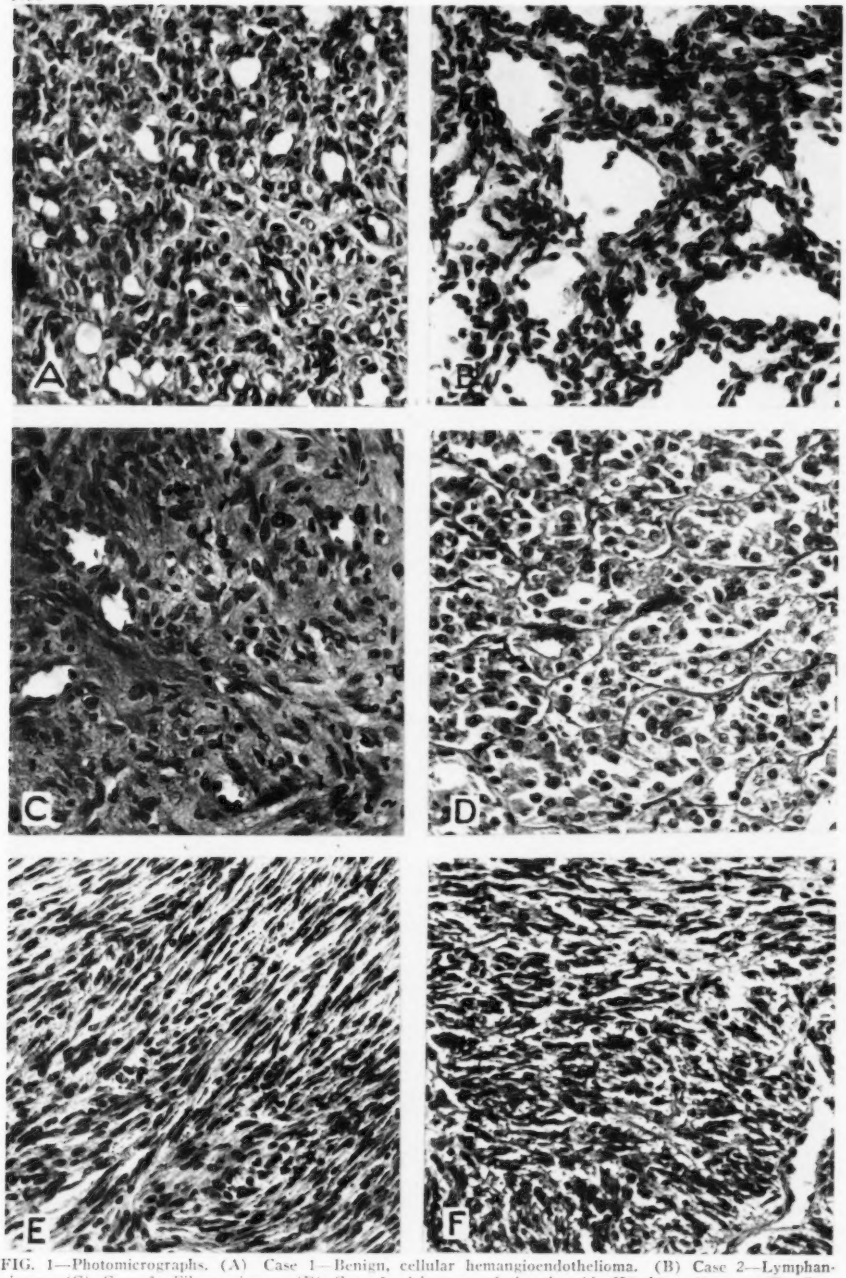

FIG. 1—Photomicrographs. (A) Case 1—Benign, cellular hemangioendothelioma. (B) Case 2—Lymphangioma. (C) Case 3—Fibroangioma. (D) Case 5—Adenoma of the thyroid, Hürthle cell type. (E) Case 7—Myosarcoma of the larynx. (F) Case 8—Myosarcoma of the bronchus. Photomicrograph of histologic findings in case 4—Fibrosarcoma—was shown in a previous presentation[1]; the histologic finding in case 6 was simple lipoma.

it to be normal. During the next two and one-half months the patient had 12 dilatations of the larynx and trachea with laryngeal bougies and the 3 mm. infant bronchoscope.

On March 8 the subglottic mass was seen as a discrete swelling; several pieces of tissue were removed for study. Histologic examination showed the tumor to be a lymphangioma (fig. 1, B). Because of the nature of the tumor a course of roentgen therapy was begun consisting of 15 treatments given at weekly intervals to four different ports for a total of 2048 r. During the 15 weeks (March 17 to June 23) that the child was receiving roentgen therapy, the mass in the left subglottic area was examined by direct laryngoscopy on an average of every 10 days; it was seen to become slightly reduced in size and to assume a purplish color. The tracheotomy tube could be plugged for several hours at a time without distress. By August 1948, when the infant was 11 months of age, the airway had improved sufficiently to permit removal of the tracheotomy tube. Laryngoscopic and bronchoscopic examinations have shown an adequate airway although some thickening of the left vocal cord has remained.

This lesion was not considered removable from a surgical standpoint and therefore irradiation was used. From the standpoint of the laryngologist, the dosage is probably somewhat high because of the possible influence on later growth of the larynx which might occur in this infant. However, so far no defect in the development of the larynx has been observed. It was necessary to carry the dosage to this level because of lack of early response of the lesion to the irradiation therapy.

Final diagnosis: Lymphangioma of the larynx.

Case 3. J.D. This white male infant was 8 months of age at the time of admission to The Children's Memorial Hospital on Dec. 10, 1948. At 5 months of age he had developed considerable laryngeal stridor; a direct examination of the larynx at another hospital had revealed a granular mass filling the hypopharynx, arising from the right lateral pharyngeal wall, aryepiglottic fold, arytenoid and ventricular band. A bronchoscope had been introduced to establish an airway and a tracheotomy performed. Histologic examination showed the lesion to be a fibroangioma (fig. 1, C). Roentgen treatments were given because of the extent of involvement of the larynx and pharynx by the tumor. One thousand six hundred and seventy-five roentgen units were given to the right side of the larynx, and 2060 r to the left side of the larynx over a two week period.

Direct examination of the larynx upon admission to The Children's Memorial Hospital showed the right side of the glottis, the right arytenoid cartilage, and the right pyriform sinus to be filled with a gray-white ulcerated mass. The tissue was extremely firm and the surrounding structures of the pharynx were red and edematous. The skin reaction showed that the area irradiated had adequately covered the tumor. However, tumor tissue obstruction of the esophagus was marked, and the dysphagia and regurgitation of food and fluids into the trachea made a gastrostomy necessary. Treatment of the tumor itself has consisted of endoscopic removal of the fungating portions of tissue in an attempt to improve the airway and relieve the esophageal obstruction. The infant's weight and general condition improved following the gastrostomy; he has been discharged from the hospital but has been kept under observation in the outpatient department. The tumor has decreased in size so that the swallowing function is slowly returning to normal although it has not yet been possible to close the gastrostoma.

It was felt that the results of the irradiation could not be evaluated until at least one year had elapsed after therapy had been completed. This infant is still under observation with incomplete regression of the tumor and, consequently, surgery is under consideration at the present time.

Final diagnosis: Fibroangioma involving the right side of the larynx and right pyriform sinus.

Case 4. R.E. This white male infant was admitted to The Children's Memorial Hospital on June 23, 1941, when 17 days old, because of a loud inspiratory crow and "blue" spells which had been present since birth. These attacks occurred repeatedly when the infant cried or exerted himself. Roentgen treatments had been given for suspected enlargement of the thymus, but no improvement was observed. On physical examination the infant was found to be well developed and well nourished, weighing 8 pounds 4 ounces (3,855 gm.) He did not appear acutely ill but had a definite inspiratory crow and difficulty in breathing. Dulness was found on percussion over the upper left side of the chest, more pronounced anteriorly than posteriorly. Auscultation of the chest was unsatisfactory because of the loud inspiratory and expiratory laryngeal sounds which were due to the laryngeal obstruction. Direct laryngoscopic examination

the day of admission revealed that the left false cord and the left arytenoid cartilage were cystic and involved in a mass which almost completely obstructed the laryngeal airway. Efforts to aspirate the contents with a needle were unsuccessful and, therefore, a tracheotomy was performed and a no. 0 tube inserted to relieve the dyspnea. A large vascular plexus was encountered overlying the trachea. Respiratory relief was immediate after the introduction of the tracheal airway, and the child began to gain weight steadily. Direct inspection of the larynx from time to time during the ensuing three weeks showed practically no change in the previous picture. There was no ulceration in the larynx, and the abnormally thickened left side of the larynx was covered with smooth mucosa. No tissue presented itself for biopsy. There were no palpable nodes in the neck. The airway improved with dilatation. Removal of granulation tissue from around the tracheostoma showed no neoplastic change in this tissue. The infant's progress appeared to be satisfactory in regard to weight gain as well as improvement in the airway until a sudden rapid downhill course began a week before death when he was 4 months old.

The postmortem examination is described in detail in the previous report of this case.[1] The lesion proved to be a fibrosarcoma compressing the left side of the larynx and upper trachea. A chain of mediastinal lymph nodes which were involved in the tumor and connected to the mass compressing the larynx was found.

A fibrosarcoma is a low grade malignant tumor. This is the only case in the literature of a fibrosarcoma of the larynx in an infant. Biopsy had not been made prior to the autopsy because all structures had been covered with normal mucous membrane. Aside from the thickening of the larynx there was no area of tumor which presented itself for biopsy.

Final diagnosis: Fibrosarcoma of the larynx.

Case 5. N.R. This 2 month old white female infant, weighing five pounds and 12 ounces, was admitted to The Children's Memorial Hospital Nov. 2, 1944, because of a tumor in the neck which was increasing in size. The birth of the child was by breech delivery at term, and at birth a mass was present in the neck. One week before admission of the child the parents noted that this mass had doubled in size. At the time the child was admitted physical examination and roentgenograms revealed a large, lobulated, irregular, somewhat cystic mass surrounding the

FIG. 2—Case 5. Lateral roentgenogram of the neck showing the mass in the neck surrounding the trachea and esophagus.

trachea in the region of the thyroid gland (fig. 2). The mass extended posteriorly and up to the angle of the mandible. Respiratory difficulty, which was moderate at the time of admission, gradually increased, and on several occasions a tracheotomy seemed imminent. Frequent aspiration of the pharynx was necessary to remove secretions which the infant had difficulty in swallowing because of esophageal compression.

By needle aspiration cells were obtained which suggested a Hürthle cell adenoma of the thyroid. Consequently, on November 18 the isthmus and portions of the lateral lobes of the thyroid were removed by Dr. J. J. Mussil. Preparations for a tracheotomy were made during the surgical procedure, but removal of the tumor released the compression of the trachea, and the airway improved during the operation. The patient had a quiet postoperative recovery and was discharged three and one-half weeks postoperatively. She received 864 r in seven doses through one anterior port postoperatively, and the residual portions of the tumor disappeared. Examination of the surgical specimen confirmed the diagnosis that the tumor was an adenoma of the thyroid, Hürthle cell type (fig. 1, D.) Follow-up examinations have shown no evidence of recurrence of the tumor.

Final diagnosis: Adenoma of the thyroid, Hürthle cell type.

Case 6. D.H. This white female infant, 18 months of age, was admitted to The Illinois Research Hospital on June 23, 1949, with progressive swelling in the left parotid region

which began when she was 4 months of age. A tumor was found inside the mouth extending from the left side to the midline, pushing all structures of the lateral pharyngeal wall to the midline. The child had considerable dyspnea and dysphagia, and roentgenograms demonstrated a defect of the left jaw which was erroneously interpreted as a pathologic fracture. It was suspected that she had a malignant tumor of the jaw and, consequently, surgical exploration of this area was made. The size of the tumor and the manner in which it compressed the jaw are demonstrated in the illustrations (fig. 3).

Final diagnosis: Huge encapsulated lipoma extending from the base of the skull to the level of the larynx causing a pressure deformity of the left mandible, dysphagia and compression of the airway.

Case 7. C.L. This 5 year old white female was first examined at The Research and Educational Hospitals of the University of Illinois on Oct. 3, 1944. Her history indicated that she had had a respiratory stridor since she was approximately 1½ years of age. This had become increasingly pronounced, and in August 1944 she had been referred to an allergist for

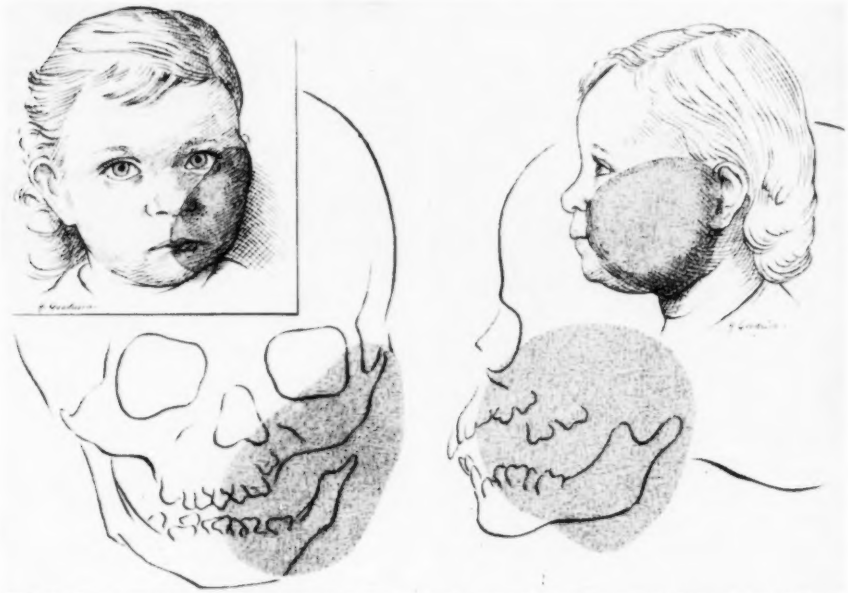

FIG. 3—Case 6. Anteroposterior and lateral views showing extent of the tumor and deformity of the jaw.

On surgical exploration (D.P.S.) a large encapsulated lipoma was found extending from the base of the skull to the level of the larynx in the left parapharyngeal space and the left pterygoid space. The left hemimandible was displaced laterally, and there was a pressure deformity. The lesion was removed. A postoperative tracheotomy was done because of the edema and pressure on the larynx itself. The tracheotomy tube was removed in seven days. The child has recovered completely without cranial nerve paralysis. The only involvement remaining is the deformity of the jaw; this is to be corrected by an orthodontist.

examination. Fifty-eight scratch tests had been made, all of which were negative. Elimination of eggs, condiments and milk had caused no improvement in several weeks. A chest roentgenogram had been reported to be negative. Because of the increasing stridor the child had been referred to The Research and Educational Hospitals where she was immediately hospitalized because of acute respiratory obstruction. The general physical examination was negative except for the respiratory symptoms. There was marked stridor with epigastric and sternal retractions, and a loud wheeze was heard over the entire chest. Roentgenographic studies of the chest were negative, but lateral

roentgenograms of the neck revealed a round mass extending into the tracheal lumen from the anterior wall about one inch below the vocal cords (fig. 4). The lobular character of the mass was demonstrated on direct laryngoscopic examination. On October 31, under general anesthesia administered through a small intratracheal tube, a tracheotomy was performed and tissue was removed from the tumor for biopsy. Postoperatively the patient developed a subcutaneous emphysema which subsided without further complication in four or five days.

FIG. 4—Case 7. (A) Lateral roentgenogram of the neck demonstrating the tumor in the trachea attached to the anterior tracheal wall. (B) Planogram, showing the limit of the tumor inferiorly.

The pathologist reported that the tumor was a neurofibrosarcoma, low grade (fig. 1, E). Because of the malignancy of this tumor and because of radioresistance it appeared that surgical resection of the lesion was indicated. On Feb. 8, 1945, the child was operated upon (D.P.S. and P.H.H.) through a midline incision which encircled the tracheostoma. Lateral skin flaps were dissected back and the lateral thyroid lobes separated from the isthmus and trachea by sharp dissection. The recurrent laryngeal nerves were isolated, found to be free of tumor, and left intact. The tracheostoma, the tumor, the thyroid isthmus, and the cervical tracheal rings were excised back to the membranous trachea from the cricoid to the sternal notch. The tumor was found occupying the anterior wall of the trachea from the second to the fifth tracheal rings. Thus, the tumor and the entire cartilaginous portion of the trachea from the cricoid cartilage to the suprasternal notch were completely excised, leaving only the posterior membranous wall of the trachea (fig. 5). Frozen sections made from the four borders of the resected area showed that tumor tissue had not invaded beyond the area resected. The cricoid cartilage was not involved in the tumor and was left in situ. The wound was packed with vaseline gauze and left open. The skin flaps were sutured to the lateral borders of the membranous portion of the posterior trachea, thus covering the exposed thyroid lobes and the recurrent laryngeal nerves. The distal trachea was sutured to the skin about the suprasternal notch to make a tracheal stoma similar to that of a laryngectomy and a no. 4 tracheotomy tube was inserted. The postoperative course was uneventful and the patient was discharged from the hospital five weeks after admission.

One year after the tracheal resection, a laryngoscopic examination was made; the larynx was found to be somewhat reduced in size, although bougies up to no. 26 could be passed through it. Because the tracheostoma remained open, the tracheotomy tube was removed. Both vocal cords could be visualized from below in the upper portion of the trache-

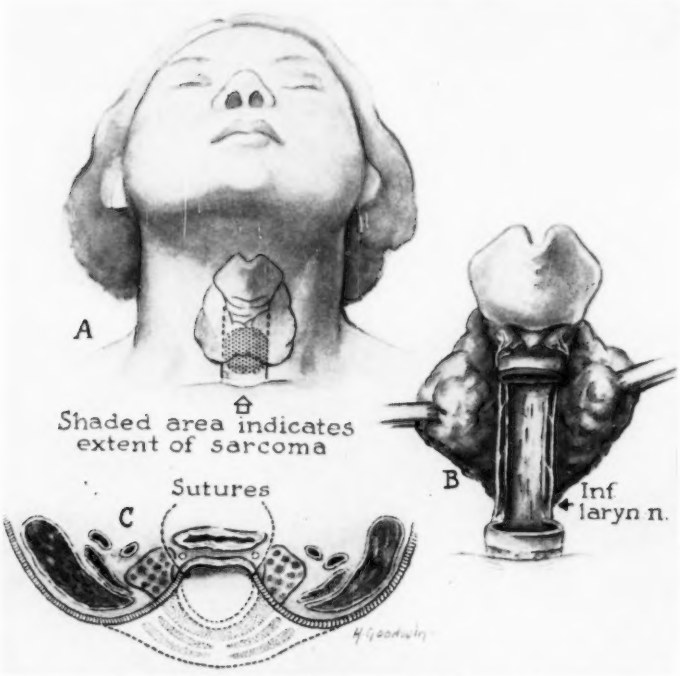

FIG. 5—Case 7. (A) Location of the tumor. (B) Extent of the resection. (C) Immediate postoperative closure.

ostoma. The patient learned to breathe and talk through her mouth by voluntarily closing the tracheostoma with her anterior neck muscles, but because of a slowly progressing subglottic stenosis retrograde laryngeal dilatations were performed. The airway through the larynx improved to allow a 4 mm. bronchoscope to pass through the larynx with ease. In May 1949 plastic closure of the tracheostoma was performed under general anesthesia by Dr. G. Kenneth Lewis. A large flap on the sternum containing a 2.5 cm. by 1 cm. piece of outer table of the sternum was elevated and turned up over the tracheostoma. The patient's airway was not adequate, however, and the tracheotomy tube was temporarily replaced. The tube was permanently removed on August 15, when the sternal skin flap was turned back over the tracheostoma and sutured in place. A split-thickness graft from the thigh was placed on the sternum. The graft healed well, and the patient was discharged in two weeks—four and one-half years after resection of the tumor.

The original histologic diagnosis was that the lesion was a neurofibrosarcoma. The slides have recently been re-studied by Dr. Fred W. Stewart and Dr. Frank W. Foote[2] of Memorial Hospital, New York. It is their opinion that this tumor should be considered a myosarcoma rather than a neurofibrosarcoma. The distinction between a myosarcoma and a neurofibrosarcoma is probably of academic interest only. The lesion is definitely a malignant one, and because of its malignancy and because of its radioresistance surgical resection of this lesion was indicated

Final diagnosis: Myosarcoma of the anterior wall of the trachea.

Case 8. P.C. This 6 year old white female child was admitted to The Research and Educational Hospitals of the University of Illinois on Aug. 1, 1941. She had had three attacks of pneumonia in the eleven months preceding hospitalization and for the immediately preceding four months had had increasing respiratory difficulty. She had no hemoptysis

but had lost weight. At birth, which occurred at term, she weighed 9 pounds and 14 ounces; the delivery was normal, there were no neonatal difficulties, and her development was normal until the onset of the present illness. Physical examination showed an emaciated child appearing chronically ill. She had a funnel breast deformity and obvious respiratory difficulty with marked depression of the lower end of the sternum on inspiration and intercostal and supra- and infra-clavicular retractions. She was pale and mildly cyanotic. Ears and eyes were normal; there was no nasal obstruction or membrane in the pharynx, and no edema. A somewhat decreased resonance on the right side of the chest and increased resonance on the left were noted, with a slight respiratory lag on the left. There was a bilateral late inspiratory wheeze. The heart, abdomen and extremities were normal, and the child was neurologically normal. Laboratory studies showed the hemoglobin to be 15 gm.; the red blood cell count, 6,310,000; the white blood cell count, 10,500; and a differential count of 24 per cent lymphocytes, 1 per cent monocytes, 72 per cent polymorphonuclears, 2 per cent eosinophils, and 1 per cent basophils. The urine was normal. Schick, Dick and Mantoux tests were negative. Roentgenographic studies of the chest showed a slight shift of mediastinal structures to the right on inspiration and toward the left on expiration, indicating an obstructive emphysema of the right lung due to partial obstruction of the right main bronchus.

A bronchoscopic examination was made on admission because of the extreme respiratory obstruction. The trachea was found to be dilated and the coryna replaced by an irregular friable mass which appeared to extend into both bronchi. A large piece of this mass was removed to establish the airway and to provide tissue for biopsy; the child had no further respiratory distress following this bronchoscopy. The histologic examination of the tissue demonstrated the lesion to be a myosarcoma of the bronchus, similar to that of Case 7 (fig. 1, F). A bronchogram demonstrated a stenosis of the right main bronchus.

Treatment consisted of a total of 1250 r through anterior and posterior portals, but further treatment was discontinued because of the marked fall in red cells and white cells. Following irradiation the blood studies were: hemoglobin, 12 gm.; red blood cell count, 1,760,000; white blood cell count, 3,600; and the differential count: 24 per cent lymphocytes, 3 per cent monocytes, 73 per cent polymorphonuclears. In spite of liver and iron therapy the hemoglobin remained at 12 gm.; the red blood cell count at 1,760,000; but the white blood cell count rose to 7,000; the differential count showed 27 per cent lymphocytes, 2 per cent monocytes, 69 per cent polymorphonuclears, and 2 per cent eosinophils. The patient's respiratory obstruction improved and she seemed quite well except for a persistence of the emphysema. All efforts to improve the blood picture were unsuccessful and the child died outside the hospital. A postmortem examination could not be made.

Final diagnosis: Myosarcoma of the bronchus.

SUMMARY AND CONCLUSIONS

Eight cases of tumors obstructing the respiratory tract of infants and children have been presented (table 1). Respiratory obstruction requiring tracheotomy or relief of obstruction by bronchoscopy was the predominant symptom in these patients. The diagnosis was by biopsy in 6 of the cases, but biopsy of small structures of the infant larynx is difficult. Every effort is made to avoid injury to the vocal cords in removing tissue for biopsy. In 1 case (4, R. E.) no biopsy was obtained because the tumor was covered by normal mucous membrane. However, in the small structures of the infant larynx removal of sufficient tissue for biopsy may through sacrifice of certain structures cause permanent injury.

From these studies it is apparent that in infants requiring tracheotomy, especially those who are difficult to extubate, tumors of the lower respiratory tract compressing the larynx or trachea, as well as intrabronchial tumors, must be considered. Surgical exploration of the neck is justified in these infants. An aggressive point of view is indicated in the management of these tumors in children; it is justified by the previous cases. Three infants have been completely relieved of their tumors by radical surgery. In retrospect, it seems probable that the infant with fibrosarcoma of the larynx possibly could have

TABLE I
PERTINENT DATA FROM 8 CASE REPORTS OF OBSTRUCTIVE TUMORS AFFECTING THE LOWER RESPIRATORY TRACTS OF INFANTS AND CHILDREN

CASE		SEX	LOCATION	DIAGNOSIS	AGE AT ONSET OF SYMPTOMS	AGE ON ADMISSION	THERAPY	TRACHEOTOMY	RESULT
1.	R.B.	Male	Neck	Hemangio-endothelioma	5 weeks	5 weeks	Surgical removal Radical neck dissection Roentgen therapy	Yes	Living and well
2.	V.H.	Female	Larynx	Lymphangioma	6 weeks	14 weeks	Laryngoscopic dilatation Roentgen therapy	Yes	Living and well
3.	J.D.	Male	Larynx	Fibroangioma	5 months	8 months	Laryngoscopic dilatation Gastrostomy Roentgen therapy	Yes	Residual tumor present
4.	R.E.	Male	Larynx	Fibrosarcoma	At birth	17 days	Laryngoscopic dilatation	Yes	Died
5.	N.R.	Female	Thyroid	Hürthle Cell Thyroid Tumor	At birth	2 months	Subtotal thyroidectomy Roentgen therapy	No	Living and well
6.	D.H.	Female	Jaw, neck	Lipoma	4 months	18 months	Surgical removal Radical neck dissection	Yes	Living and well
7.	C.L.	Female	Trachea	Myosarcoma	1½ years	5 years	Resection of trachea. Plastic repair	Yes	Living and well
8.	P.C.	Female	Trachea	Myosarcoma	5 years	6 years	Bronchoscopic removal Roentgen therapy	No	Died

been saved by a total laryngectomy, even though that total laryngectomy would have had to be done on an infant 2 or 3 months of age.

REFERENCES

1. Rigby, Ralph G. and Holinger, Paul H.: Fibrosarcoma of the larynx in an infant, Arch. Otolaryng., 37:425-429 (March) 1943.

2. Stewart, Fred W. and Foote, Frank W.: Personal communication.

DISCUSSION

HENRY B. ORTON, M.D., Newark, N. J.: These case reports on unusual obstructive lesions of the respiratory tract in infants and children presented by Dr. Holinger are most interesting.

Developmental errors of the thyroid gland may occur as accessory thyroids in the posterior triangle, along the carotid sheath or high up in the region of the hyoid bone. Carcinoma occurs very frequently in these aberrant thyroids at a very early age, more frequently than one might believe. Some authorities believe that aberrant thyroids are due to metastatic invasion of lymph nodes from the thyroid proper.

I can recall about 6 cases of thyroid carcinoma causing respiratory obstruction in children. I have at the present time a tracheotomized patient, 3 years of age, with masses involving both bifurcations of the carotid. I also have had 2 cases in which the thyroid completely surrounded the trachea in infants. This condition was discovered in both patients at autopsy. These cases are all tragic.

The large hygromas cause respiratory obstructions due to the infiltration of the tissues causing pressure on the airway. I recall 1 case of a large cystic hygroma extending from the edges of the lower jaw to the clavicle on both sides, giving the appearance of a bull neck, even extending upward into the tongue. At the time of the operation this child was 3 weeks old. He is now 10 years of age and well.

Another patient, a week old infant, was tracheotomized for respiratory obstruction caused by the hygroma infiltrating the posterior pharyngeal wall. This patient was also operated upon and is well now, six years later.

Papillomas in children and infants deserve mentioning. They must be carefully watched, not only for obstructive signs but also for the possibility of malignant change. I know of 2 cases in which such change occurred.

Congenital abnormalities of the esophagus, such as esophagotracheal fistula and partial obliteration of the esophagus, cause obstruction by allowing food to enter the trachea and bronchi. Here, however, some encouragement in the treatment of these conditions is offered by the thoracic surgeons, provided diagnosis is made early enough.

We have also to consider cyst of the lung, mediastinal tumors, lymph nodes at points of bifurcation, dermoids of the mediastium, and tumors of the trachea. Early diagnosis of these conditions no doubt will be of great help in treatment.

C. L. JACKSON, M.D., Philadelphia, Pa.: This most unusual series of cases could be presented only by someone with enormous quantities of clinical material. I think it is most interesting to bring together in a report of this kind a group of cases pathologically so different and clinically so similar in the problem they present, not only interesting but of great practical value. I think Dr. Holinger's presentation has shown us very clearly the inseparability of laryngology and bronchoesophagology as well as their intimate relationship with other specialties. If successful management of cases of this kind is to be accomplished, real teamwork, such as has been shown in his presentation, is necessary.

I think Dr. Holinger has shown us very well the necessity for courageous approach to these problems, and I fully agree with him that we very often tend to be too timid in dealing with problems of this kind in children, and especially infants. The tendency is to do a tracheotomy and let the child grow a little, let the larynx get a little bigger, before following through with the diagnostic studies such as biopsy. I think he has shown us very impressively the necessity for abandoning this timid attitude and for going right ahead to establish a histologic diagnosis.

Finally, I should like to ask Dr. Holinger if he feels that all of these tumors were malignant. As I understood his presentation, it seemed to me that two or three of them, while tumors, would not be grouped as malignant tumors. I should like him to classify them for us, if he will, please.

DR. SLAUGHTER: As Dr. Holinger indicated when he started his presentation, the title was changed from "malignant tumors" simply to

"unusual tumors." The lymphangioma was benign. The hemangioma had been originally but erroneously diagnosed as malignant: it was benign. Of course we could classify them as "positional" malignancies because there would have been total obstruction of breathing eventually.

All I wish to do is to re-emphasize that we must have an aggressive attitude in these cases. We have been able to salvage by surgical means three children whose cases were otherwise hopeless.

Another point I wish to emphasize strongly is the danger in the use of radiation in growing tissues. We had to resort to it in some of these cases, but there is in such a situation a quality of hopeless fatalism. Sometimes we say, "Let's see what radiation will do." It would, of course, have done nothing for the lipoma case except cause further damage, and it would have done nothing for the sarcoma in the child who was salvaged. These are surgical problems, and although a complete neck dissection in infants is certainly watch-making surgery, the anatomic relationships are just as definite as in an adult, and it can be done quite satisfactorily. A clean, healed surgical wound will always give better late results (10, 15, or 20 years later) than heavy radiation, and certainly in infants the effects of radiation on the growth development of all the tissues, even the cervical spine, should, I think, make us use the surgical approach wherever possible.

NONMALIGNANT GRANULOMATOUS LESIONS OF THE NASAL AND ORAL CAVITIES

FRED Z. HAVENS, M.D.
ROCHESTER, MINN.

THE term "granuloma" is defined as a tumor or neoplasm made up of granulation tissue. Granulation tissue represents tissue response to injury. Such injury may be induced by mechanical, thermal, toxic or infectious agents. There is an imposing array of diseases in which nonmalignant granulomatous lesions may be found in some part of the nasal or oral cavity or in the skin adjacent to them. I think I am safe in saying that none of these diseases is encountered frequently.

The following list is arranged alphabetically in order to avoid any suggestion as to relative frequency or importance: blastomycosis, coccidioidomycosis, eosinophilic granuloma, factitial lesions, histoplasmosis, indeterminate lesions, leishmaniasis, leprosy, moniliasis, rhinoscleroma, rhinosporidiosis, syphilis and tuberculosis.

Time does not permit more than a brief discussion of these various diseases but this will serve to emphasize the possibilities which must be borne in mind when one is confronted by the diagnostic problem of a granulomatous lesion involving the nasal or oral mucous membranes. Although I am here discussing nonmalignant granulomatous lesions, let me say that always the possibility of malignant disease must receive first and careful consideration. Granulomatous lesions that are malignant will be observed more often than those that are nonmalignant. I shall discuss first those diseases with which I have not had experience.

From the section on laryngology, oral and plastic surgery, Mayo Clinic.
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COCCIDIOIDOMYCOSIS

Coccidioidomycosis is caused by the fungus Coccidioides immitis and the disease is endemic in the San Joaquin valley in California. The early phases of the disease are characterized by fever, cough and erythema nodosum. There may be pulmonary findings resembling those of tuberculosis. Granulomatous lesions involving the nasal or oral mucous membranes appear in the later stages of the disease.

LEISHMANIASIS

Leishmaniasis appears to be of three types. One, a visceral type, is found chiefly in the eastern hemisphere and is caused by Leishmania donovani. Another, also a disease of the eastern hemisphere, is caused by Leishmania tropica and is characterized by lesions of the skin. This disease is known by various names but most commonly it is called "oriental sore." A third form, called "American leishmaniasis," is found most often in Brazil and Peru but it is not confined to these regions. Because it has been studied extensively by Brazilian investigators the organism causing it is called Leishmania braziliensis. It is reported[3] that in American leishmaniasis involvement of the nasal or oral mucous membranes does occur and that such occurrence may be serious because of the chronicity and destructive tendency of the disease. Early lesions are said to appear most commonly on the anterior third of the nasal septum and to have a punctate granulomatous

appearance at first, followed by vegetation and ulceration. The pharynx or larynx may be involved but much less frequently than the nose. Positive diagnosis rests upon the results of cultural studies.

LEPROSY

Pinkerton[6] has had an extensive experience with leprosy and has reported his observations. He has stated that early lesions often are found involving the nasal septum, usually at the mucocutaneous juncture. First there is congestion, then edema or infiltration, followed by the formation of nodules which break down and finally heal with marked scar formation and atresia of the nostrils. He has carefully described his technic for preparing smears of serum obtained after carefully and superficially abrading the mucosa over a suspected lesion.

MONILIASIS

Moniliasis of the larynx has been described by Clerf and Bucher.[2] They stated that "the presence of a laryngeal lesion exhibiting extensive chronic inflammatory changes more or less granulomatous in character, in a patient who presents no evidence of tuberculosis or syphilis, should suggest fungus infection." They carried out detailed investigations and proved definitely that the fungus in their cases was Candida (Monilia). Because of the fact that blastomycosis is caused by a fungus similar to Candida and which produces similar lesions, they collected from the literature and discussed several reported cases of blastomycosis.

It is worthy of emphasis here that cultures of fungi require a very long time to grow. In discussing Clerf and Bucher's paper, the senior Chevalier Jackson related that in a case of his own, in which blastomycosis was suspected, cultures were made and after a "long" time were considered to be without growth. The culture dishes were set aside to be cleaned but were forgotten and when discovered after another six weeks "there was a beautiful growth and it was a pure culture of Blastomyces."

RHINOSPORIDIOSIS

Rhinosporidiosis is caused by a sporozoan parasite, Rhinosporidium kinealyi, and the nasal lesions are described as friable, polypoid, easily bleeding masses. The disease is found chiefly in Ceylon and India. Broders[1] has stated that only once has tissue been submitted to him for diagnosis which proved positive for this disease. This statement from a pathologist of his wide experience is an index to the rarity of the disease in this country. Modern means of travel, however, will increase the possibility that the disease may be encountered. The diagnosis is made on histologic examination. The organism has never been isolated.

A visiting Hindu physician recently gave an interesting commentary regarding this disease in his country. He stated that it was most prevalent in a portion of India inhabited by descendants of the early French and Portuguese explorers. These people, so the story goes, are extremely cleanly and like to bathe frequently. Their facilities for bathing, however, consist chiefly of streams and natural pools. The disease is transmitted by bathing in infected water; consequently we have the paradox of a people suffering from a serious disease because of their desire to be exceptionally clean.

It has been my good fortune to have observed instances of the following either in my own patients or in those of my colleagues.

BLASTOMYCOSIS

The typical mucosal lesion of blastomycosis has a granular appearance, and sometimes tiny yellowish points, which look like (and apparently are) super-

ficial abscesses, can be seen around the periphery of the lesion. If the latter can be seen at the periphery of a questionable lesion, one may strongly suspect blastomycosis. I saw one of the cases of blastomycosis of the larynx reported by Dr. New.[4] The lesions had a granular appearance and were grayish "as if they had been touched with silver nitrate." Another patient had a pinkish granular lesion on the outer aspect of the lower alveolar process anteriorly. Around the periphery of this lesion were the tiny yellowish nodules previously described. Microscopic and cultural studies revealed Blastomyces. This patient had also enlarged submaxillary nodes and a lesion in one lung suspected of being blastomycosis.

The diagnosis of blastomycosis rests on the results of microscopic and cultural studies. The microscopic appearance of a biopsy specimen may closely resemble that of tuberculosis. Careful darkening of the microscopic field may aid in discovery of the characteristic budding double-refractive organisms.

EOSINOPHILIC GRANULOMA

Eosinophilic granuloma is so named because microscopic examination of biopsy specimens reveals numerous eosinophils. The pathologist will report "granulomatous inflammatory tissue with numerous eosinophils" or "chronic inflammatory tissue with fibrosis and numerous eosinophils." Nothing is known regarding the cause of the disease.

A description of such a lesion taken from our files reads "hard tumor of bridge of nose which has developed in the course of four years." Another reads "hard masses in right temporal region and right lower eyelid — seven months' duration." Because treatment by irradiation has resulted in prompt regression of these lesions I discussed with our pathologists the question whether the lesion might be neoplastic rather than inflammatory. The pathologists insist that the lesion is not neoplastic.

FACTITIAL LESIONS

I here use the term "factitial lesions" to designate lesions induced by the patient himself. In such patients there usually is a background of emotional conflict. The means employed for production of the lesion may be chemical or thermal but usually it is mechanical and often is only the hands or fingernails. It may be very difficult to arrive at a diagnosis in a patient with a lesion of this type. Usually it is only after extensive fruitless search has been made for other causes that suspicion begins to dawn upon the examiner. Illustrated is the defect involving the nasal ala together with scarring about the left eye which resulted from such a lesion (fig. 1). When first seen and before the riddle had been solved the lesion was a proliferative granulomatous affair. It healed very promptly as soon as its true nature was suspected and measures were taken to prevent further self-inflicted trauma.

HISTOPLASMOSIS

Histoplasmosis has received a great deal of attention in recent years. It appears that the fungus (Histoplasma capsulatum) may attack any part of the body and that often it attacks various parts of the body simultaneously. Fever, loss of weight and enlargement of the liver and spleen are frequent findings. It has been my good fortune to have seen 2 patients who had oral lesions. The amount of loss of weight was striking in both cases, 108 pounds (about 49 kg.) in one and 50 pounds (about 23 kg.) in the other. Interestingly, too, the man who had lost 50 pounds did not appear ill. The oral lesions in these 2 patients were almost identical in their appearance and this differed definitely from that of any

other lesion with which I am familiar; sufficiently so that at the primary examination of the second patient a note was made that "this may be histoplasmosis." In each of these 2 patients the lesions were firm and granular and did not bleed when traumatized as do most granulomatous lesions. When a specimen for biopsy was taken it was noted that the tissue was very firm—almost like scar tissue. Definite confirmation of the diagnosis is made by cultural studies but the fungus may be visible in stained specimens of tissue.

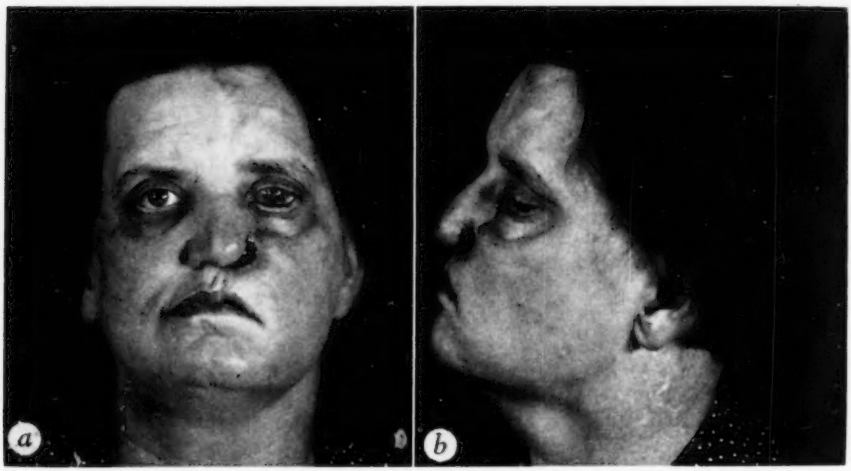

FIG. 1—(a and b) Scarring resulting from a factitial granuloma.

INDETERMINATE LESIONS

There is a granulomatous lesion now and then encountered which involves the nasal or oral cavity and which my colleagues and I have always referred to as an "indeterminate granuloma." Various names have been applied to this lesion by others such as "granulomatous ulcer of the nose and face," "osteomyelitis necroticans faciei," "gangrenous osteomyelitis of the paranasal sinuses," "chronic infectious ulcer of the nose of unknown cause." Recently my colleague, Dr. Williams,[8] has written a paper discussing lesions of this type. He has termed the lesion "lethal granulomatous ulceration involving the midline facial tissues." I believe this title to be well chosen because it describes and locates the lesion and also indicates the general prognosis. It would be difficult to improve upon his description of the lesion and of the diagnostic problems; therefore, I shall quote portions of his paper.

> From time to time one encounters a patient with a granulomatous lesion having its primary site in the tissues of the nasal chambers or palate, usually running an indolent course for a year or two, sometimes even appearing to heal for a short time but again breaking down for no obvious cause. After a few months to a few years the lesion becomes more active and invades the neighboring bony structures, destroying the nose, palate and maxillary air sinuses, frequently with preservation of the upper lip, resulting in a shocking facial deformity. These patients die either from pure exhaustion or from hemorrhage.
>
> The striking thing about these granulomas is the indolent but inveterate development of the lesions; where from their appearance we expect signs of active suppuration, none is present; the slow destructive advance suggests some sort of malignant lesion or blood dyscrasia. Histologic studies of the tissues of the lesion, of the blood and of the bone

marrow have, however, failed to furnish any evidence to confirm this suspicion.

The pathologist studying sections of the diseased tissues appears to be struck by the absence of the usual signs of resistance to infection. Organisms which are found casually invading the tissues without the customary leukocytic barrier being set up do not appear to be the cause of the lesion. With the antibiotics of the present day such organisms may be completely eliminated from the tissues without affecting the progress of the disease. After stoppage of antibiotic treatment another different organism may appear invading the tissues in the same manner.

The bacteriologist and the mycologist have been unable to discover an etiologic agent.

Dr. Williams has made an exhaustive and thorough study of this problem and has propounded the hypothesis that this type of granuloma may result from some disorder of the immune mechanism and therefore possibly should be considered as an allergy.

My colleagues and I have seen an occasional patient with an indeterminate granuloma who has been cured. Sometimes cure appears to have resulted from treatment with a light dosage of roentgen rays and sometimes it has followed treatment by thoroughly cleansing the lesions daily with hydrogen peroxide either alone or in combination with some germicide. Illustrated is one of these who was treated by a combination of the foregoing methods (fig. 2). At one time we had 3 successive cases in which the peroxide treatment apparently was responsible for cure and we thought we had the answer to the question as to how to manage these cases, but we since have seen other patients who did not obtain benefit from the same measures.

Treatment by cleansing the lesion with hydrogen peroxide first was sug-

FIG. 2—(a) Indeterminate granuloma. (b) Same patient after healing.

gested by my colleague, Dr. John B. Erich. Use of it may result in gratifying improvement or even cure. Furthermore it is something one can be doing for the patient during that trying period while one is awaiting the results of cultural and other studies.

RHINOSCLEROMA

Rhinoscleroma is endemic in central and southeastern Europe but cases have been reported from almost all parts of the globe. It is caused by Klebsiella rhinoscleromatis. The histologic appearance is not entirely characteristic but the presence of large vacuolated "foam" or "lace" cells containing gram-negative diplococci is suggestive. A definite diagnosis can be made by means of cultures of biopsy specimens.

The disease runs an extremely chronic course; consequently the clinical findings will vary, depending upon the length of time the disease has been present before the patient is seen. Early symptoms may be nothing more than rhinitis, later there may be tenacious fetid discharge and still later a granulomatous lesion which sometimes is flat and sometimes is exuberant. In the latter case it may produce an easily bleeding mass blocking, protruding from, or even extending outside, the nostril. If the lesion is in the larynx, it may be evident only as a subglottic thickening. Deforming scarring may be evident in later stages of the disease owing to its tendency to chronicity and spontaneous healing.

In earlier cases irradiation was used with very gratifying results. Recently New and his co-workers[5] have reported the case of a patient apparently cured with streptomycin.

SYPHILIS

Syphilis may be the cause of granulomatous lesions involving the nasal or oral cavities. Tertiary lesions of syphilis are more likely to resemble the lesions under discussion than are those of primary syphilis. Any uncertainty regarding such lesions seldom should long exist if appropriate serologic studies are made.

TUBERCULOSIS

The oropharyngeal lesions of tuberculosis usually are granulomatous and dirty gray in appearance, and frequently are painful. Associated with the ulcerated lesion there may be considerable edema of adjacent tissues. This is particularly true in the larynx, where ulceration may be limited to the true or false cords, but with this there may be marked edema of the soft tissues surrounding the arytenoid cartilages. In the nose, owing to the effect of the air stream, the granular lesions may not be moist but instead may be covered by crusts. The diagnosis may be made by microscopic examination and I believe can usually be made accurately. There are some observers, however, who prefer not to accept a diagnosis of tuberculosis unless it is confirmed by the results of cultural studies or by positive results following inoculations of guinea pigs.

BACTERIOLOGIC STUDY OF SUSPECTED TISSUE

The following suggestions for bacteriologic study of suspected tissue have been supplied by my bacteriologist colleague, Dr. Weed.[7]

In order to make a satisfactory bacteriologic examination of a specimen removed for biopsy the material should be obtained and handled aseptically. The tissue should be finely minced with sterile scissors and ground to a fine paste in a sterile mortar. Saline solution or broth should be added to make a 10 to 20 per cent emulsion. If blastomycosis, coccidioidomycosis, histoplasmosis or moniliasis is suspected the emulsion should be streaked on blood agar plates or Sabouraud's agar and incubated at 30 C. Blastomyces and Histoplasma will usually grow more rapidly on blood agar than on Sabouraud's agar. If leishmaniasis is suspected the material should be streaked on

blood agar slants and growth if any will be found in the water of condensation. If rhinoscleroma is suspected the organism (Klebsiella) will be quickly isolated on blood agar but the material should be incubated at 37 C. If tuberculosis is suspected the material should be inoculated into guinea pigs (either subcutaneously, intraperitoneally or intramuscularly in the thigh). The animals should be examined six to eight weeks later. Any suspicious lesions should be examined histologically and a diagnosis of tuberculosis can be confirmed by demonstrating acid-fast bacilli within them. If syphilis is suspected and if it is desired to isolate the organisms, 0.25 to 0.5 cc. of the tissue emulsion should be injected intratesticularly into a rabbit and the animal should be examined for evidence of orchitis once or twice a week for one to three months. If leprosy is suspected an acid-fast stain should be made of the emulsion and of the block used for histologic examination.

Granulomatous lesions involving the nasal or oral cavities may present difficult or even insoluble diagnostic problems. Histologic study of biopsy specimens should receive first consideration because malignant granulomatous lesions will be encountered more frequently than will those which are nonmalignant. In conjunction with histologic study complete bacteriologic studies must be made also.

REFERENCES

1. Broders, A. C.: Personal communication to the author.
2. Clerf, L. H. and Bucher, C. J.: Moniliasis of the larynx, Tr. Am. Laryng. A., 58:78-90, 1936.
3. Fox, Howard: American leishmaniasis: report of case observed in Brazil, Arch. Dermat. & Syph., 23:480-502 (March) 1931.
4. New, G. B.: Blastomycosis of the larynx, Tr. Am. Laryng., Rhin. & Otol. Soc., 34: 347-352, 1928.
5. New, G. B., Weed, L. A., Nichols, D. R. and Devine, K. D.: Rhinoscleroma apparently cured with streptomycin, Ann. Otol., Rhin. & Laryng., 57:412-417 (June) 1948.
6. Pinkerton, F. J.: Leprosy of the ear, nose and throat: observations on more than two hundred cases in Hawaii, Arch. Otolaryng., 16:469-487 (Oct.) 1932.
7. Weed, L. A.: Personal communication to the author.
8. Williams, H. L.: Lethal granulomatous ulceration involving the midline facial tissues, Ann. Otol., Rhin. & Laryng., in press.

DISCUSSION

COL. J. E. ASH, Washington, D. C.: I will restrict my remarks pretty much to the general question of granulomatous inflammations. At the risk of being considered a purist I should like to take exception to Dr. Havens' first remark that granulomatous inflammations are neoplastic tumors of granulation tissue. To the pathologist, granulation tissue is developed in the healing of exudative inflammations. The granulomatous inflammations are hyperplastic lesions involving the endothelium, the large mononuclear cells. Granulomatous inflammations can be divided into two groups. The first group includes the orthodox ones in which the response is the development of the tubercle, of which the lesion of tuberculous infection is the classic example. There are a number of etiologic agents that stimulate the tubercle formation, however, and a number of those Dr. Havens has included in his discussion—tuberculosis, syphilis, several of the fungous infections, particularly coccidioidomycosis and blastomycosis, foreign bodies—but there is also, as Dr. Havens has indicated, the "indeterminate" group, in which the etiology is not discernible. It is not possible for the pathologist to determine the etiology simply by the morphology of the material that he examines under the microscope because the tubercle resulting from infection by the tubercle bacillus can be mimicked by a number of other etiologic agents.

Years and years ago, before we knew as much about etiology as we do now, these tuberculoid forms of granulomatous inflammation were comparatively simple. We called them all tuberculosis or syphilis and that was the end of it. They now, however, have come to be just as difficult to the poor pathologist as to the clinician.

The second form of granulomatous inflammation is manifested by a profuse proliferation and infiltration of the large mononuclear cells, usually with the absence of frank tubercle formation. These occur in those diseases in which the etiologic agent has a special predilection for endothelium. Pertinent to our purpose in this group are histoplasmosis, leprosy, and rhinoscleroma.

I want to say just a word about several of the diseases that Dr. Havens has mentioned. First, the fungous infections, that for our purposes can be put into two categories. There are those that tend to remain superficial in the skin and mucous membranes, typical examples being Aspergillus infections of the external auditory canal, and thrush, the monilial infection of the mucous membrane. The reaction to these infections is exudative and not granulomatous. The second group includes those that involve deeper tissues and at times become generally distributed. Blastomycosis and coccidioidomycosis are two such infections. They do stimulate tubercle formation and differ from the superficial fungous infections by being present in the tissues only in the spore stage. Blastomycosis is most commonly a local infection of skin or mucosa, but occasionally it breaks loose and metastasizes in other tissues, particularly bones and the lungs, and it is then always fatal. Coccidioidomycosis is generally a lung infection primarily and remains so, simulating pulmonary tuberculosis very closely, but in a small percentage of victims the infection spreads to other parts and is then fatal. This situation is particularly liable to occur in the Negro, according to our experience with the Army material.

It is usually not possible for the pathologist to make an exact species identification of fungi from what he sees in the tissues, except that the budding spore does identify Blastomyces and the endospore-containing cyst, Coccidioides. The final species identification is a problem for the mycologist using cultures.

Rhinoscleroma or, as you prefer to call it, scleroma is of more than passing interest in this country. It is true that the endemic centers are in other portions of the world, particularly Egypt and the Near East, but we have in the registry at the Armed Forces Institute of Pathology half a dozen or so cases that apparently developed in this country. We had a particularly interesting experience of some historical importance just recently. We discovered a jar in the old Museum containing a larynx that had been excised back in 1904. It came from a young Negro who had lived in Washington all his life and had had a history of laryngeal and upper respiratory difficulties for several years. He finally died, apparently of suffocation, and the larynx was presented to the Museum. It had been cataloged as a chronic laryngitis, but on histologic examination it was quite evident that it was really scleroma. It is, therefore, the earliest evidence of the disease in this country.

Rhinosporidiosis is also endemic in this country. We have 8 or 9 cases in the registry, including 2 or 3 where the infection was of the conjunctiva rather than of the nose. It is endemic, of course, in Ceylon. Dr. Reddig, the pathologist from Ceylon, to whom Dr. Havens referred, stopped in to see us also, and the particular thing that impressed me in his story was that scleroma is always a disease of males, and this in spite of the fact that the females bathe in the same infected pools used by the men. There is no satisfactory explanation for this phenomenon.

Just one point about leprosy. Leprosy is more common in this country than, I am sure, many of you realize unless you come from southern Texas and around the Gulf. The otolaryngologist and the dentist frequently have the opportunity to encounter first those conditions that manifest themselves on the face, the ears, the oral mucosa; and while it might seem remote to worry about leprosy, it is something that you have to keep in mind. The one point I want to make about leprosy is that, while the classic method of diagnosis is a smear from the septum, it is not infallible. The lesion on the nasal septum, while common, is not always present so that negative nasal smears by no means eliminate the possibility of infection.

I have just a few slides that might be of some relevance in this discussion.

(Slide) Blastomycosis is not a very common infection in the mucosa. It occurs most commonly on the skin of the face or on the extremities, particularly the lower extremities. We have two instances of blastomycosis of the vocal cords, and the last one was apparently a primary and solitary infection of the cords. It was of particular interest because the patient had been treated for tuberculosis for at least a year in different parts of the country, and it was not until a biopsy was made that the true nature of the condition was manifest. There are certain histologic characteristics of blastomycotic infections that the experienced pathologist can identify as at least suspicious evidence of the infection before he finds the spores. On the skin there is a characteristic ulceration and a very characteristic hyperplasia of the squamous epithelium, and this hyperplasia can be extensive enough to simulate carcinoma. In addition to that, there are tubercles, and, the third criterion, micro-abscesses, polymorphonuclear lymphocytes, an exudative reaction as well as a granulomatous reaction. That combination — hyperplasia of the epithelium, tubercles, and abscesses—is very suggestive of blastomycosis.

(Slide) It is not, however, until one finds the doubly contoured budding cysts, usually in

the giant cells, that one can differentiate Blastomyces from cyst of Coccidioides.

(Slide) There are two forms in which leishmaniasis may come to your attention in addition to the "boils" of the Eastern Hemisphere, the Aleppo boil, for example, that occurs on various parts of the anatomy. There are two specific manifestations in the South American infections, one which involves particularly the ears of the chicle gatherers in Central America, and the more serious, deforming mucocutaneous lesions, espundia (slide), that may result in great deformity of the nose.

I think we owe a debt of gratitude to Dr. Havens for calling our attention to this very important although not terribly common category of conditions. As he emphasized so rightly, not only is the specific granuloma itself serious but an accurate diagnosis is necessary in order that specific treatment may be instituted. The fact that granulomatous inflammations may simulate a malignant lesion, and vice versa, is an additional important reason for careful consideration of any refractory lesion of the skin and mucosa connected with your special field.

ARTHUR C. CURTIS, M.D., Ann Arbor, Mich.: Dr. Havens has had a very important and difficult subject to discuss, and I congratulate him on the large amount of material that he covered in the short time he had. I likewise have seen numerous examples of that type of granuloma which he called the "indeterminate" granuloma. It has always seemed to me that this type fits those often called pyoderma gangrenosum, which are occasionally seen associated with diseases like ulcerative colitis. Mellanby's symbiotic gangrene is another type of destructive granuloma that at times will be seen in association with other diseases or occurring spontaneously. Such lesions are very destructive and due to a host of aerobic and anaerobic organisms.

In treatment I likewise have used either hydrogen peroxide or zinc peroxide. The latter can be made into a paste of approximately 50 per cent zinc peroxide mixed with water and applied on the lesions two or three times a day.

In using granuloma in its broad sense, I think one should also include two granulomatous lesions which were not included in the discussion by Dr. Havens. The first is the granulomatous lesion produced by Torula histolytica (Cryptococcus neoformans) and the second, the granulomas that fall into the category of sarcoidosis. I should like to show you just a few examples of those.

(Slide) This is a woman who has a torulosis (cryptococcosis). The extensive destructive and crusted lesions as well as the acneform lesions on her face are plainly visible. The myelogenous leukemia preceded the development of the deep mycotic infection. The organisms of Torula histolytica were obtained by direct examination and culture from the lesions. This is the third case of torulosis that we have had in the hospital during the past year.

(Slide) This is a clinical example of a granulomatous lesion which one might think was tuberculoid leprosy since the patient happens to be an East Indian. There was involvement of the ears and ala of the nose, as well as destructive bone lesions. Biopsy showed the pure epithelioid cell lesion of sarcoidosis.

(Slide) At times one may see a patient who has had sarcoid disease for many years. This patient's first sarcoid lesion began on the face 27 years ago. Later, the skin of the extremities, the bones and the lungs were involved. All tissues taken for pathologic study, including bones, were characteristic of sarcoidosis.

(Slide) Sarcoidosis can involve any part of the body except the hair, nails and teeth. It is often the cause of the syndrome commonly called Mikulicz's disease. In 10 or 15 per cent of the cases that have sarcoidosis, there may be involvement of the eye. In this case the so-called mutton-fat deposits were present on the posterior portion of the cornea and anterior surface of the iris.

(Slide) As this process continues, and it has in this case, blindness occurs.

(Slide) Dr. Havens talked about the eosinophilic granulomas, of which there are two types. One consists of small hard single, or sometimes multiple, tumors that pathologically show a great many eosinophils in them. The etiology of the tumor is not known. Another form of eosinophilic granuloma is that which occurs in bone and has been known to the orthopedic surgeons for years. It has been shown by Lever that in all probability this disease belongs to the family of xanthomas. This patient is a little girl who had cutaneous lesions in the axilla, on top of the head (slide) and on the vulva. Pathologically, the skin lesions were eosinophilic granulomas. X-ray studies showed destructive lesions of the mastoid, second rib, and left ilium. This was an eosinophilic granuloma of skin and bone. With roentgen therapy all of the lesions cleared, including those in the bone.

(Slide) This is the last granuloma to be discussed. There is nothing particularly char-

acteristic about it. It is on the upper lip, is firm, and I would certainly be hard put to diagnose it by its clinical appearance. I have seen examples of this granuloma on the tongue and elsewhere in the body and I have never known exactly what it was until I had a pathologic examination made of it. This happens to be the granulomatous lesion of histoplasmosis on the lip. This was a fatal case of the disease, and in addition to the cutaneous lesions, the patient had enlargement of the liver and spleen, leukopenia, fever and the clinical picture we now know as more or less characteristic of the disease.

D. M. LIERLE, M.D., Iowa City, Ia.: Dr. Havens has given us a very informative review of the nonmalignant granulomatous lesions which may be found in the nasal and oral cavities or adjacent areas. One of the most frequent granulomas that we have seen has been the one which we have called chronic infectious granuloma. I agree with Dr. Havens that Dr. Williams' name, "lethal granulomatous ulceration involving the midline facial tissues," is well chosen.

Several years ago, in 1942, I presented a case of chronic infectious granuloma of the nose which was very similar to those described by Dr. Havens. This case was particularly interesting because of the fact that the lesion on several occasions was apparently healed, only to recur later. The patient was a young married woman, 22 years of age, who in 1935 noticed a slight ulceration in the left vestibule of the nose. There was some nasal discharge and she complained of pain in the left cheek and upper teeth on the same side. At times she had a low grade fever, excessive lacrimation and headaches. There was no clinical or roentgenographic evidence of sinus disease.

The lesion apparently responded to local treatment consisting, first, of boric acid compresses and, later, of hydrogen peroxide. Between January 1937 and January 1941 the patient was seen in the out clinic on three occasions with a recurrence of the ulceration, and each time the lesion responded to the simple treatment described. She returned in September 1941 and reported that the nose had been well until May of that year, when she received a mild blow. Following this the nose became swollen, tender and bluish in color, and an abscess developed in the floor of the nose. The examination revealed a badly disfigured nose with extensive ulceration of the nasal tip and floor on the left side. There was a profuse purulent discharge, crusting and bleeding with the slightest manipulation. She was admitted to the hospital and the disease slowly progressed in spite of the various types of treatment. During the period of hospitalization the following treatment was carried out:

1. Local applications of boric acid dressings and various ointments and dye antiseptics.
2. Administration of sulfanilamide, sulfathiazole and sulfadiazine.
3. Roentgen irradiation (400 r).
4. Administration of mapharsen.
5. Routine antisyphilitic therapy (department of syphilology).
6. Fever therapy.
7. Repeated transfusions, intravenous injections and other supportive measures.
8. Zinc peroxide.
9. High vitamin therapy.

The laboratory, on one occasion, reported the presence of anaerobic streptococcus, and zinc peroxide was used. At first there was decided improvement, but later the disease progressed. The use of zinc peroxide was based on the success of Meleney's treatment. He has shown that the beta hemolytic streptococcus which is present in these lesions is a facultative anaerobe, or, as he calls it, the microaerophilic hemolytic streptococcus.

Several of you have seen the colored motion picture film of this patient which I presented at the meeting of the American Laryngological Association in 1942.

DR. HAVENS: In presenting this paper I tried only to give a very brief working outline for the benefit of anyone who might be confronted with one of these problem cases. I would like to thank Dr. Curtis for calling attention to the difference between granulomas of the midline tissues of the face due to anaerobic and micro-aerophyllic organisms and which respond to nascent oxygen therapy and those granulomatous lesions in this location in which no such etiology or any other etiology other than "allergy" can be found and for which no effective therapy has been discovered. Differential diagnosis in such cases should always include anaerobic culture.

THE IMPORTANCE OF THE IMPEDANCE FORMULA IN THE INTERPRETATION OF AUDIOGRAMS

PAUL A. CAMPBELL, M.D.
CHICAGO, ILL.

FOR a number of years engineers, physicists and others have applied the so-called impedance formula to the solution of certain problems concerning vibration and sound transmission. The formula, among other attributes, makes it possible to predict or to explain the effects upon the characteristics of a sound transmission system which are produced by variation of stiffness, mass or friction of or between any of the elements of the system.

Mathematically stated the formula is as follows:

$$\text{Impedance} = \sqrt{r^2 + \left(m \cdot f - \frac{s}{f}\right)^2}$$

Where f = frequency; r = friction; m = mass; s = stiffness.

Although the formula is imposing its most important features can be readily simplified.

Impedance from the otologist's viewpoint may be defined as any resistance to transmission of vibratory energy by a sound conduction system. The sound conduction system in which we are interested is, of course, the conduction portion of the auditory apparatus. Thus by definition practically all forms of conduction deafness are due to impedance. It follows that, if we are able to determine the cause of impedance in a given instance of conduction deafness, we will probably be able to determine the cause of the deafness which we are studying. It also follows that, if a clue to the various causes of impedance can be identified by characteristic pure tone audiometric curves, we will then have another important tool for differentiation between the etiologic factors of conduction deafness. A general working knowledge of the impedance formula offers this as well as other forms of aid.

H. Johansen[2] in his excellent monograph on the subject of utilization of the impedance formula has re-emphasized the importance of application of such known physical principles and has simplified the concept into something quite useful.

Basically, the impedance formula states that the effects of change in stiffness and mass of any of the elements of the conduction system are in reciprocal relationship. Furthermore, it states that in conditions in which added stiffness is the predominant feature hearing for low frequencies will be affected more than those for high frequencies. On the other hand, in those instances in which added mass is the predominant feature hearing for the higher frequencies will be depressed more than that for the low. Stated in other terms, increase in *stiffness* of any of the elements of the conduction system will produce predominantly low tone deafness, whereas increase in the *mass* of any of the elements of the conduction system will produce predominantly high tone deafness.

Using the seesaw analogy presented by Johansen[2] the resultant basic audiometric curves of the two types of physical effect may be diagramatically illustrated (fig. 1).

Turning to the differential diagnostic implications of the portions of the for-

From the department of otolaryngology, Northwestern University Medical School.
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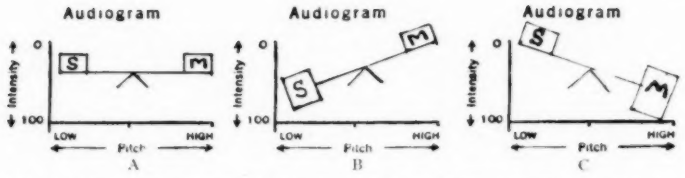

FIG. 1—The seesaw analogy of Johansen.[2] The impedance formula is a mathematical statement of relationships which can be best simplified by the seesaw analogy. In this analogy one considers the air conduction curve of hearing of an audiogram to be a child's seesaw or teeter-totter with the fulcrum of the board in the general region of the 2,000 to 3,000 frequency. A hypothetical object *S* representing the stiffness factor is placed on the low tone end of the board while another hypothetical object *M* is placed at the high tone end of the board. The quantity *M* represents the factor of mass. As in the case of the seesaw any increase in the factor *S* (stiffness) will tilt the board or the threshold curve downward in the low tone area and upward in the high tone area. The same effect is accomplished by decreasing the *M* (mass) factor. On the other hand an increase in the *M* (mass) factor will tilt the high tone end of the board (or the threshold) downward. Again this same effect is accomplished by decreasing the *S* (stiffness) factor. Audiogram A shows the normal threshold situation in which the mass and stiffness factors are in equilibrium. Audiogram B shows the tilt of the threshold curve into the low tone area when the stiffness factor is increased or the mass factor is decreased. Audiogram C illustrates the tilt when the factor of mass is increased or that of stiffness is decreased. The analogy fits the facts somewhat better if the board is thought of as somewhat elastic or bendable.

mula which have to do with stiffness and mass, some of the commoner conditions which influence these factors may be listed as follows:

Common Causes of Increase in Stiffness of Elements of the Conduction System

1. Splinting effect of unequal pressure on the two sides of the tympanic membrane.
2. Fixation of the footplate of the stapes.
3. Endolymphatic hydrops.[3]
4. Adhesions between the ossicles or between the ossicles and the wall of the tympanic cavity.
5. Contraction of intra-aural musculature.

Common Causes of Increase of Mass of Elements of the Conduction System

1. Thickening of the tympanic membrane.
2. Hemorrhagic bleb on the tympanic membrane.
3. Pus, blood or serous fluid in the tympanic cavity.
4. Organized exudate in the tympanic cavity.
5. Localized hemorrhage into the substance of the tympanic membrane.

Common Causes of Combined Increase of Stiffness and Mass of Elements of the Conduction System

1. Negative pressure of tympanic cavity with consequent serous or serosanguinous fluid production in the cavity.
2. Purulent otitis media with positive pressure and pus production.
3. Organizing pus, blood or serous fluid in the tympanic cavity.

The audiograms in figure 2 demonstrate curves which are in accordance with the predictions of the formula for the type of lesion which was present. It is granted that these are selected examples and probably fit the predictions more completely than would be the case if the audiograms were selected at random.

Audiogram A demonstrates the hearing changes resulting from the splinting or stiffening effect of a comparatively

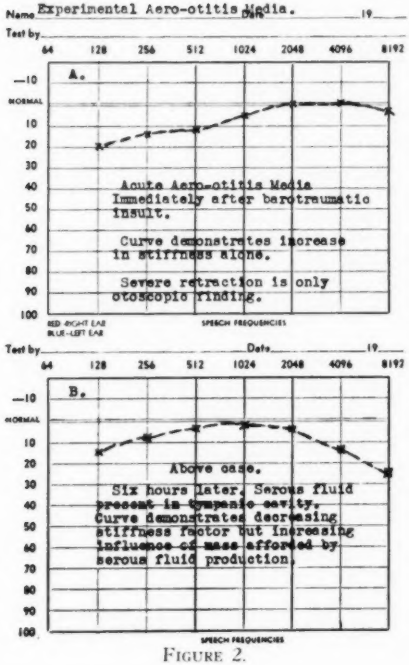

FIGURE 2.

high degree of negative pressure (vacuum) in the tympanic cavity. In this instance it resulted from an experimental altitude chamber descent from an altitude of 14,000 feet, during which the act of swallowing and other acts which normally ventilate the tympanic cavity were suppressed. The audiogram was made immediately after descent was completed, consequently very little if any compensatory fluid production had taken place. The audiogram fits fairly well the predicted curve for stiffness acting alone.

Audiogram B demonstrates the results in the same experiment six hours after audiogram A was recorded. At this time compensatory fluid production in the tympanic cavity had taken place. Fluid could be seen through the tympanic membrane. The drum, while still slightly retracted, was also engorged. Thus one would predict the audiogram to show the results of decreasing stiffness and at the same time the added mass produced by the fluid. This situation can be seen in the audiogram. It is interesting to note that the downward swing of the curve in the higher frequencies takes place with the fulcrum in the 2048 area. This seems to be the usual situation.

Otosclerosis, in those instances in which partial fixation of the footplate of the stapes is the sole pathologic change, would be expected to furnish an ideal example of the effect of increased stiffness. Analysis of audiograms of several otosclerotic patients demonstrates this to be true sufficiently often to remove it from the category of chance (fig. 3). In this connection it is of interest to note that G. E. Shambaugh, Jr.,[4] in 1938 pointed out the difference of

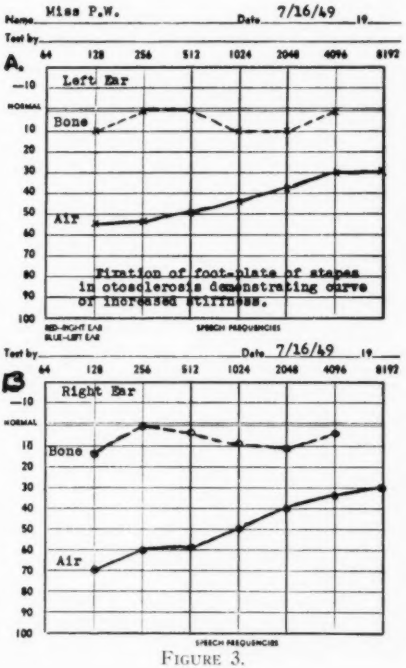

FIGURE 3.

contour between air conduction audiometric curves of otosclerosis and those of secretory otitis as a possible diagnostic aid. This difference can now be explained on the basis of the impedance formula.

So far nothing has been stated in this presentation concerning the friction factor of the formula. As a matter of fact, little is known although its influence is being studied by a number of competent investigators. Recently R. Carhart and A. Juers[1] have pointed out the comparative constancy of a dip in the bone conduction curve of otosclerotic patients which is deepest in the area in the neighborhood of 2000 to 3000 cycles per second. Carhart has suggested that this dip fits, in a general manner, the contour of the predicted curve for increased friction as calculated by P. Binzer and H. Johansen.[2] This dip is evident in the bone conduction curves of audiograms A and B (fig. 3).

To continue, the factor of added stiffness, according to the formula, would also be expected to be present in those audiograms representing spasm or contraction of the intra-aural muscles. The audiograms A and B (fig. 4) presented by H. D. Smith[5] as showing the effect of voluntary contraction of the tensor tympani upon the hearing curve furnish an interesting example. The curve showing the decline in the lower frequency range is exactly as would be predicted. The notch in the high frequency area is difficult to explain although it has characteristics of a friction effect, which it could readily be.

An example of a curve corresponding to the formula's prediction of the effect of increasing the mass of an element of the conduction system may be seen in audiogram C (fig. 5). This audiometric curve results from the added mass afforded by a rather large (2 mm. by 6 mm.) hemorrhagic bulla involving the external layer of the tympanic membrane. The diagnosis was that of myringitis bullosa of influenzal origin. Incision of the bulla with subsequent healing removed the factor of added mass and as predicted allowed the high fre-

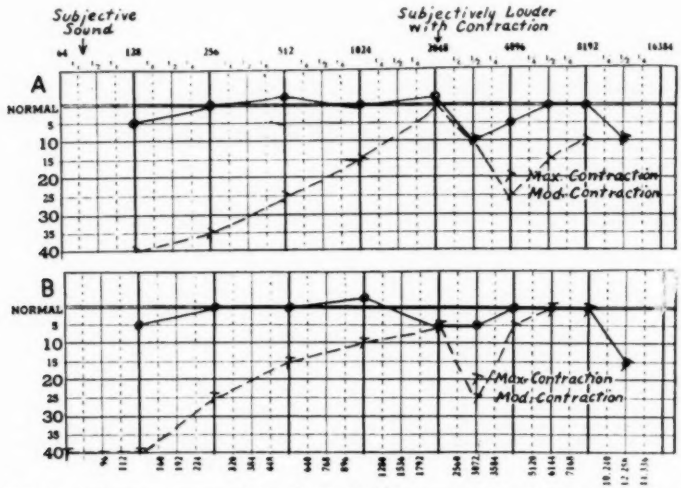

FIG. 4—Audiograms presented by H. D. Smith[5] demonstrating the effect of contraction of the tensor tympani muscles on the threshold of hearing.

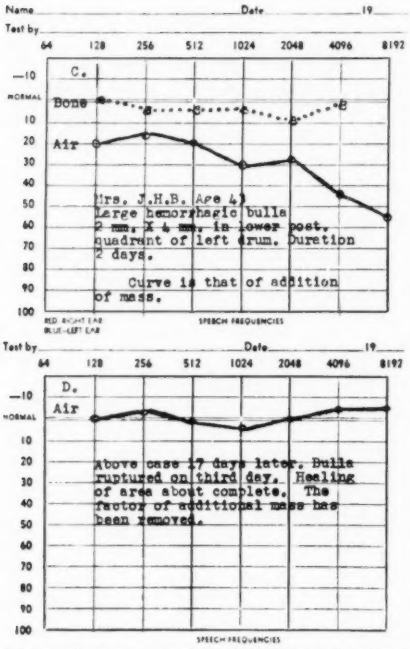

FIG. 5—Audiogram C. Line B illustrates the tilting effect of added mass. In this instance the added mass has produced a large hemorrhagic bulla on the tympanic membrane. Audiogram D is the recovery audiogram.

quency portion of the curve to swing upward into a more or less normal position as illustrated in audiogram D in the same figure.

The resultant curve of a combination of increased mass and stiffness can be seen in the upper audiogram of figure 6. This audiogram was made during the earlier stages of acute purulent otitis media. At the time the audiogram was made, increased pressure inside the tympanic cavity was causing the drum to bulge producing the factor of increased stiffness. This factor is reflected in the downward tilt of the low tone end of the curve. The mass factor produced by pus caused the downward tilt of the high tone end of the curve. Recovery, as would be predicted, allows both ends of the curve to swing upward into approximately normal position. The recovery curve may be seen in the lower audiogram of figure 6.

Time limitations make it impossible to go into more than a small segment of the interesting applications of the impedance formula which one meets in the everyday practice of otology. It might be pointed out, however, that its application is of extreme importance in the study of day-to-day or week-to-week progress of many of the conditions which we follow. From the standpoint of interesting utilization of theory let us turn to a prediction of the effect of the fenestration operation and the changes in hearing which follow the procedure.

The ideal case for the fenestration operation should be that in which the only pathologic condition is that of increased stiffness produced by fixation of the footplate of the stapes. Thus, from the standpoint of theoretic con-

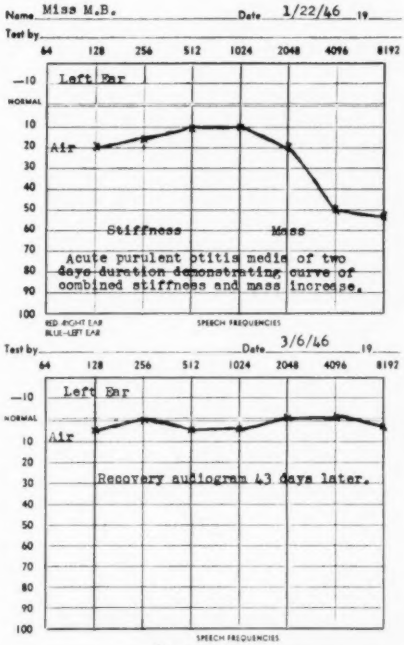

FIGURE 6.

siderations of the formula, the ideal air conduction audiometric picture would be that of an inclined threshold curve ascending continuously from the lowest frequencies to the highest. The bone conduction curve should coincide with normal threshold and should be flat with the possible exception of a small notch into the 2000 to 3000 frequency area.

At operation, formation of the fenestra removes a small area of the barrier which lies between external sound source and the endolymph portion of the sound conduction system. A small amount of mass is removed but, much more important, stiffness of the system is decreased in relatively large degree. Thus one would predict an upward seesaw-like swing of the low tones with the fulcrum of the seesaw in the 2000 to 3000 tone region. There should be some lowering of the high tone threshold from the effect of the stiffness factor. The placing of the tympanomeatal flap should be expected to add enough mass to decrease the hearing for high tones to some extent; however, this effect is probably more than compensated for through improvement in coupling. During the healing stages organizing clot, if it is present, and edema would be expected to lower the curve of hearing in the high tone range while stiffness produced by fibrous adhesions and further organization of the clot would be expected to lower the curve for low tones.

It is admitted that theory does not always coincide with practical experience; however it is intriguing, and very often quite helpful, to apply theoretic considerations.

Before concluding, another point concerning the use of the formula for the purpose of prediction is of interest. According to the formula the earliest stages of fixation of the footplate of the stapes should be evident in the tilting of the air conduction curve of the audiogram. This change in position of the threshold curve should be present even though there is practically no loss of hearing in the conversational area. From the standpoint of theory, hearing for the higher frequencies might be even better than normal average (fig. 7). With this in mind the author recently analyzed several audiograms of members of otosclerotic families and found this tilt present in a few of the younger members who have manifestly normal hearing. Possibly such a curve may predict otosclerosis with manifestations to appear in the future.

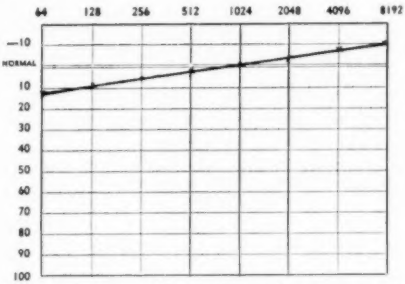

FIG. 7—The tilt of the threshold of hearing as should be expected if the stiffness of the system is slightly increased. Early stages of fixation of the footplate of the stapes without manifest hearing loss could produce such a curve.

It must again be emphasized that the formula is applicable only to conduction phenomena and takes into account no neural or perceptual change whatsoever.

In conclusion, it is not the essayist's intention to claim credit in any way for the development or application of this formula. It is, however, his desire to emphasize by means of examples of application its extreme importance as a diagnostic tool and to interest more otologists in its utilization.

SUMMARY

1. The impedance formula, utilized by engineers and physicists for a number of years, has been demonstrated by investigators to have important appli-

cation to the problems of conduction deafness.

2. This formula states that factors which increase the stiffness of any of the elements of the conduction system will produce hearing loss predominantly in the lower frequencies, whereas those factors which increase the mass of any of the elements of the conduction system will produce hearing loss predominantly in the high tone range.

3. Otologists, especially those of this hemisphere, are not giving enough attention to the application of the formula.

REFERENCES

1. Carhart, R.: Personal communication.
2. Johansen, H.: Relation of audiograms to the impedance formula, Acta oto-laryng., Supp. 74:65-75, 1948.
3. Mygind, S. H.: Further labyrinthine studies: I. Affections of the humoral system of the labyrinth, Acta oto-laryng., Supp. 68: 7-50, 1948.
4. Shambaugh, G. E., Jr.: Recent advances in the diagnosis and treatment of deafness, Ann. Otol., Rhin. & Laryng., 47:636-648 (Sept.) 1939.
5. Smith, H. D.: Audiometric effects of voluntary contraction of the tensor tympani muscles, Arch. Otolaryng., 38:369-372 (Oct.) 1943.

DISCUSSION

SCOTT N. REGER, Ph.D., Iowa City, Iowa: Dr. Campbell's timely paper undoubtedly will be instrumental in focusing additional attention and study on the mechanical aspects of middle ear physiology in relation to localization and diagnosis of middle ear pathologic conditions.

The middle ear sound-conducting apparatus may be regarded as a highly specialized and highly developed type of mechanical impedance-matching or coupling device, designed and created by Mother Nature to enable a more or less efficient transfer of vibrational energy from an elastic medium of relatively little density—the atmosphere—to a medium of considerably higher density—the fluids of the inner ear.

The efficiency ratio or mechanical advantage of the drum and ossicles is commonly stated to be between 60 and 90, obtained by multiplying the ratio of the area of the footplate of the stapes to the area of the drum by the lever ratio of the ossicles. The normal middle ear vibrating structures possess a given value of impedance, derived in part from this mechanical advantage of their structure, which can be expressed quantitatively in mechanical ohms. It must be emphasized that normal acuity is dependent upon efficient impedance matching of the middle ear vibratory structures between the atmosphere and the inner ear fluids. Instead of stating that conduction deafness is due to impedance, it is preferable to state that conduction deafness is due to changes in the impedance of the middle ear structures.

The impedance equation cited by Dr. Campbell is that for a simple vibrating system in which the mass, stiffness and friction are combined in series. An impedance equation which would be more applicable to the middle ear is much more complex, consisting of several series, parallel, and series-parallel parameters, involving the mass, stiffness and friction factors. Series and parallel combinations of these factors produce diametrically opposite results in frequency response characteristics.

The discusser feels that the many variables involved are so complex, and it is so difficult, if not impossible, to obtain accurate quantitative values for the mass, stiffness and friction factors in question, that interpretation of conduction deafness on the basis of theoretic middle ear impedance changes is not always a conclusive procedure.

For those interested in additional reading or study, a monograph of 254 pages and a bibliography of 57 references by Otto Metz on "The Acoustic Impedance Measured on Normal and Pathological Ears," published as Supplementum 63 of *Acta oto-laryngologica*, is suggested. Incidentally, Metz found no difference in the acoustic impedance of normal ears and ears with labyrinthine hydrops. If any of you have ever thought that the decibel is difficult to understand, wait until you crash head on into the impedance concept.

Needless to say, Dr. Campbell's paper has stimulated my interest greatly in middle ear impedance problems. If ever I read a paper on the subject, I here and now publicly request that Dr. Campbell be given an option to discuss it.

NORTON CANFIELD, M.D., New Haven, Conn.: Application of the impedance formula which Dr. Campbell discussed is another instance of a co-operative effort in which the acoustic physicist explains phenomena observed by the experimental and clinical otologic physiologist. Albeit a patient with hearing loss may not present a clinical picture or audiogram which the formula can fully explain, many cases, as Dr. Campbell has mentioned,

can be made clearer to the practicing otologist if he understands the principles of physics herewith included.

The training of most otologists has included nothing but the most meager attention to mathematics and physics, so we are deficient in our appreciation of the tools used so easily by our colleagues in physics as they are, too, unversed in the clinical picture of ear disease.

If I may take the liberty of attempting to restate the formula under discussion, we can say that the ability of sound to penetrate the structures of the ear to the cochlea depends upon four factors: (1) friction, (2) stiffness, (3) frequency of sound pattern, and (4) weight of the moving parts.

Attention to the mathematical symbols expressed in the formula places these four factors in their proper relationship.

As a clinician it is not easy for me to place these four factors in many of my audiograms so that the resulting calculation of impedance carries a clear picture. I am further confused by the conditions which Dr. Campbell mentions as being examples of increased mass combined with increased stiffness. "Pus, blood or serous fluid in the middle ear" is difficult to differentiate clinically from "purulent otitis media with positive pressure and pus formation." According to Dr. Campbell, the former increases mass while the latter increases both stiffness and mass.

Again, although it is clearly stated that the formula relates only to cases of conduction deafness, the clinical differentiation of impaired hearing cases still leaves much to be desired and care must be exercised if we use this impedance formula to interpret an audiogram when notations on that audiogram may be due to an otherwise unsuspected neural abnormality.

Strict application to cases in which stiffness only is a factor increasing impedance gives a good explanation of the improvement seen following the fenestration operation. Application of the formula also indicates why it is that the upper two frequencies following fenestration operation are seldom improved in the final analysis of an individual case. On the basis of the formula it *may* be possible, therefore, to state categorically that, when the two higher notes are down, a portion of the hearing loss is due either to a neural lesion or to increase in the factor in the formula designated as mass. In such a case, decrease in the stiffness as a result of a fenestration operation may not result in a satisfactory actual improvement in hearing acuity. An explanation of the failure to obtain hearing improvement in fenestration of cases of chronic adhesive nonsuppurative otitis media is also possible by applying this impedance formula. Any physical principle which will add to our diagnostic acumen or improve our prognosis for patients considered for fenestration operation is a welcome addition to our present inadequate diagnostic criteria.

DR. CAMPBELL: In closing I should like to thank my discussers and to say that I wholeheartedly agree with everything they say. I do believe that we have a very helpful principle here and that if we remember some rule of thumb such as that implied by the seesaw analogy we will be able to better analyze our audiograms, especially when we are looking for a cause for a particular type of conduction contour.

I should like to answer one of Dr. Canfield's questions. He inquired about the stiffness and mass factor in purulent otitis media. It seems to me that in the early stages of many cases of purulent otitis media there is a rapid pressure increase inside the middle ear which, as we know, produces the bulging of the drum. Bulging of the drum, I believe, shows that there is a factor of increased stiffness acting along with the mass factor. After the bulging, and consequently the stiffness, is reduced by paracentesis or rupture the mass factor alone remains.

POSTERIOR NECK INFECTIONS

COLBY HALL, M.D.
LOS ANGELES, CALIF.

DEEP infection in the posterior triangle of the neck commonly simulates Bezold's abscess. It is, therefore, the immediate concern of every otolaryngologist. The purpose of this paper is to present a report on a neck infection occurring frequently enough in the author's experience to warrant description as a distinct clinical entity. No new disease or new fascial space is being claimed. Indeed, the anatomy involved and the surgery indicated are both simple and fundamental.

Upon being told that the lesion is a lymphadenitis of the superior deep cervical nodes, one's natural inclination is to remark, "Just another cervical adenitis." Closer scrutiny of the cases reveals several reasons why this is *not* "just another cervical adenitis." Let us ponder these reasons.

The disease is localized in a very small area. The acute infection, for some unknown reason, is confined to the upper deep cervical nodes, with no adenitis elsewhere (fig. 1, A and B). Anatomically, the pathologic lesion lies beneath or medial to the sternomastoid muscle and the more superior its position the more closely the picture resembles Bezold's disease. In many cases pus appears to lie in the same fascial plane as in Bezold's, but its mode of arrival differs entirely. While Bezold's results from rupture of pus through the mastoid tip, this is a suppurative adenitis.

From the department of otolaryngology, School of Medicine of the University of Southern California. The original drawings were made by Mr. Ted Bloodhart, Los Angeles.
Presented at the Fifty-Fourth Annual Session of the American Academy of Ophthalmology and Otolaryngology, Oct. 9-14, 1949, Chicago, Ill.

The carotid sheath is in the immediate neighborhood of the infection (fig. 1, A and B). If sufficient proximity exists there may be a periphlebitic process involving the internal jugular vein, or a "perijugular abscess" as described by Mosher in regard to pharyngomaxillary disease. Indeed, we have seen a leukocyte count of 35,000 accompanied by a temperature of 106 degrees. Carotid erosion, however, in this particular disease has not been seen by the author.

Torticollis and stiffness of the neck associated with pain resulted in one patient being studied as a polio suspect during a recent epidemic, while another was thought to have a disease of the cervical spine.

When one combines the above facts with the absence of any common etiology, for most cases give little or no clue as to the cause, one must conclude that this is *not* "just another cervical adenitis."

Our clinical discussion can well commence by quoting Kerrison. In his "Diseases of the Ear" he states in describing Bezold's abscess, "It presents a swelling below the mastoid in the neck, which, if other symptoms of mastoid disease were not clear, might present difficulties of diagnosis." From a study of figure 2 one might ask, "Which twin has the Bezold's?" Figure 2, A, is an example of Bezold's taken from Lederer's "Diseases of the Ear, Nose and Throat," while figure 2, B, shows a patient with a typical posterior triangle infection. In the former there existed ear and mastoid infection, while in the latter there was no evidence of otitic disease. Need-

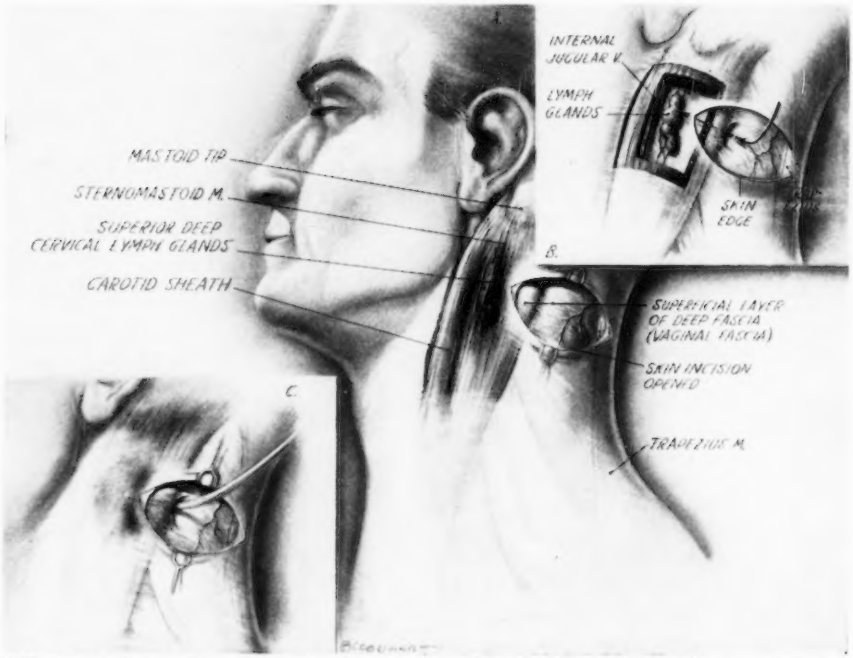

FIG. 1—(A) Relationships of the upper deep cervical nodes. (B) Arrow indicates the area of surgical approach through the occipital triangle. (C) Curved forceps entering the abscess cavity.

less to say, the therapeutic indications differed greatly in the two patients.

Upon further examination of the patient, one notes a distinct torticollis. There is a characteristic rotation of the head toward the normal side with lateral flexion toward the diseased side (fig. 3, A). The patient is able to turn his head, with pain, in the direction of the normal side, *but* upon attempting to rotate his head in the direction of the diseased side the head, neck, and shoulder all move together as if they were splinted. This is due to the intense inflammatory induration involving the sternomastoid, the scaleni and the other cervical muscles in this region. These are signs which differentiate this disease from superficial adenitis.

Patients with deep infection complain of pain and stiffness in the neck 12 to 24 hours preceding the appearance of any external swelling. Point tenderness is extreme from the onset. The smooth indurated swelling should be easily differentiated from chronic processes by the history and the examination.

In superficial adenitis where the diseased tissue lies *upon*, rather than deep to, the cervical fascia, one can often palpate the irregularity of many glands; and later, if suppuration occurs, fluctuation will be apparent. Figure 4 shows a superficial suppurative adenitis. Posteriorly the swelling was indistinguishable from deep infection, but the patient presented no torticollis, no difficulty in rotating the head in either direction, and fluctuation was present.

Should one base his hopes of diagnosis upon history and etiology he will find that he is usually aided only in a negative way. Despite the rich afferent lymphatic system which supplies the su-

FIG. 2—(A) Bezold's abscess (Lederer: Disease of Ear, Nose and Throat). (B) Posterior neck infection (upper deep cervical adenitis).

FIG. 3—Deep suppurative adenitis (beneath cervical fascia). (A) Swelling in left neck, rotation of head to opposite side, and lateral flexion toward the diseased side. (B) Typical swelling on the left not unlike Bezold's. Normal contour on the right. (C) Five days postoperatively. Penrose drain in place.

FIG. 4—Superficial suppurative adenitis (superficial to cervical fascia). (A) The patient has no torticollis. (B and C) The head can be rotated in either direction. (C) The swelling appears more superficial and better defined than in the deep infection. (D) Posterior view is indistinguishable from deep infection.

perior deep nodes there is rarely found any definite cause, let alone any common etiology, for this acute infection. A poor, vague and unsatisfactory history is the rule. Two patients presented scalp infections resulting from hair-straightening compounds, while in a third an allergic scalp condition had been present since childhood. If these were causative, then it is puzzling why such a small and isolated group of glands was solely involved. The history of a mild sore throat or "maybe a slight cold" is sometimes obtained after forceful and pleading interrogation. One physician suddenly became ill with fever, neck pain, neck swelling and extreme toxicity. Relevant history included a mild pharyngitis one month previously and the fact that she had been working long hours with cases of acute laryngotracheobronchitis, in all of which the culture showed Streptococcus viridans. The pus obtained from this physician's neck abscess also cultured Streptococcus viridans.

A careful history is valuable in ruling out other diagnoses.

There has been no characteristic bacteriologic picture. Streptococcus hemolyticus and Streptococcus viridans have been cultured in some cases, while "no growth" has been a frequent report in others. The latter may have resulted from strenuous chemotherapy and antibiotic therapy in some instances, and failure to make proper anaerobic studies may have accounted for others. In three recent cases the chemotherapy and antibiotic therapy were followed by such prompt subsidence of the external swelling and such rapid improvement of symptoms that surgical drainage was unnecessary and material for culture was not available.

The leukocyte count usually varies from 13,000 to 15,000 with the polymorphonuclear response of acute disease. In one patient the white cells increased to 35,000. The temperature has always reached 101 F., and in some instances it has risen to 106 degrees. It is significant that the temperature has immediately subsided following surgical drainage.

CASE REPORT

The patient shown in figure 3 was referred as probably having a Bezold's abscess. He presented the complete clinical picture characterizing deep infection in the posterior triangle. This boy, 19 years old, complained of pain and stiffness in the neck on Nov. 13, 1948. Two days later, when first seen by the author, he displayed all the significant signs, namely: the rotation and tilt of the head, the tender boardlike swelling in the posterior triangle, a leukocyte count of 15,400, a temperature of 101 degrees, extreme malaise, and neither ear nor mastoid disease.

He gave a vague history of mild sore throat three weeks previously. These findings have been common to all acute infections involving this area.

Penicillin was administered in adequate dosage from the onset. On November 18, five days after the first symptom, a tiny area of redness was discernable over the mass. This area blanched upon gentle digital pressure. Fluctuation was absent, but slight pitting occurred when pressure was applied to the area of redness. The toxicity increased, the swelling enlarged and became more tender, and the temperature rose to 102.4 F. On November 19, six days after the onset of pain, the abscess was incised and drained despite the absence of fluctuation. Because there is no embarrassment of airway in this type of case, pentothal anesthesia was administered safely and satisfactorily. Approximately 4 cc. of pus, under pressure, was recovered from a small abscess cavity deep to the sternomastoid muscle, and a Penrose drain was inserted. The temperature promptly subsided, the toxic symptoms disappeared and the wound was healed 10 days postoperatively.

It is our opinion that deep infections in this region should be managed in exactly the same manner as deep neck infections elsewhere. Rational and adequate chemotherapy and antibiotic therapy should be instituted immediately, and if the objective signs increase and the symptoms remain unabated despite

this therapy, incision and drainage are indicated. However, should subsidence of the objective and subjective signs occur, then common sense dictates a nonsurgical course.

It is the opinion of the author that fluctuation in deep neck infections is important *only when present*. The absence of fluctuation in the presence of other surgical indications should never deter one from performing surgical drainage. Fluctuation has been uniformly absent in all the deep posterior infections we have treated. However, one very valuable sign has been present, namely, an area of slight pitting upon firm pressure. I believe this to be highly suggestive of pus beneath the cervical fascia.

In all cases of suppuration in the posterior triangle the size of the abscess cavity has been small and the quantity of pus recovered at surgery has never exceeded 8 cc.

The site of surgical incision is most important in shortening the period of drainage and convalescence. A review of figure 1, A and B, reveals the diseased area lying beneath the sternomastoid muscle and the cervical fascia. The cervical fascia, which forms a sheath for the sternomastoid, continues posteriorly to envelop the trapezius muscle. As depicted in figure 1, A and B, there exists a triangular sheet of fascia between the posterior edge of the sternomastoid muscle and the anterior edge of the trapezius. This offers a safe area for the surgical approach to deep suppuration in the posterior triangle. A transverse skin incision should be extended posteriorly from the posterior border of the sternomastoid, and when the edematous subcutaneous tissues have been divided, the tense and prominent cervical fascia will become apparent. This fascia is opened with a curved forceps or scissors and the abscess entered by directing the instrument anteriorly deep to the sternomastoid muscle as shown in figure 1, C. In a neck which is markedly indurated and swollen it is often difficult to decide just where the incision should begin, with the result that it is commonly placed too far anteriorly. A safe rule is to make the incision farther posteriorly than the eye indicates because the abscess cavity is always entered from behind forward. In two of our cases the incisions were placed too far forward, the sheaths of the sternomastoids were opened, and the result was an unnecessarily prolonged convalescence in each instance. Although it is often difficult to recognize the landmarks in a cellulitic neck, one can, by careful surgical approach, recognize the posterior border of the sternomastoid; when this has been accomplished there should be no further confusion of landmarks. In every case in which the incision has been made posterior to the muscle the wound has healed rapidly.

CONCLUSION

It is indeed fortunate that all the features of this posterior infection are not as indefinite as is the etiology. The consistent clinical picture, so easily explained by the simple anatomy, is in sharp contrast to the complete absence of anything simulating a consistent, common or relevant history. Nevertheless, and in spite of our inability to adequately explain this localized acute adenitis, we should, by remembering the characteristic clinical picture, the anatomy involved and the surgery indicated, be prepared to recognize and to treat rationally this type of posterior neck infection.

DISCUSSION

FLETCHER D. WOODWARD, M.D., Charlottesville, Va.: Dr. Hall has brought to our attention a clinical entity. Although rare in occurrence, its recognition is important, and the surgical approach he has so well presented is so logical that I am sure such cases will receive better care in the future because of his observations.

Bilateral postcervical adenitis, as seen in rubella, scalp and nasopharyngeal infection, is not rare. But a unilateral deep cervical node swelling, such as he has described, is rare and must be differentiated from Bezold's abscess, branchial cyst, actinomycosis, jugular vein phlebitis, Hodgkin's disease, metastatic malignant nodes, and others. In some of these, the primary cause is obvious; in many, the cause is obscure. It is in this group that Dr. Hall's observations are most pertinent.

When pain, tenderness, and swelling do not subside after adequate therapy, surgical exploration should be employed, since fluctuation is not to be expected in these deep abscesses, and in many only a small amount of pus may be found. If suppuration is not present, tissue may be removed for biopsy and cultures obtained for bacteriologic examination. The surgical technic as advocated is both logical and adequate and should give a minimum amount of discomfort to the patient.

In Memoriam

William David Donoher.....Los Angeles, California
October 11, 1949

M. Jean Gale.....Denver, Colorado
November 18, 1949

R. P. Higgins.....Cortland, New York
January 13, 1949

Emerson Stanley Hill.....Torrington, Connecticut
October 26, 1949

Albert George McAuley.....Montreal, Canada
December 28, 1949

Roy Carlyle McLaughlin.....Los Angeles, California
October 12, 1949

Eugene E. Neff.....Madison, Wisconsin
October 31, 1949

James Timothy O'Hora.....Detroit, Michigan
November 9, 1949

Robert Eldon Repass.....Miami, Florida
October 27, 1949

F. G. Stueber.....Lima, Ohio
December 25, 1949

TRANSACTIONS

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AMERICAN ASSOCIATION OF EYE, EAR, NOSE AND THROAT SOCIETY SECRETARIES

ANNUAL MEETING — 1949

The tenth annual meeting of the American Association of Eye, Ear, Nose and Throat Society Secretaries was held at the Palmer House, Chicago, on Tuesday evening, Oct. 11, 1949, during the convention of the American Academy of Ophthalmology and Otolaryngology. The Academy extended its courtesy to this secretarial group by providing an excellent dinner for the members and guests.

The meeting was called to order by the president, Dr. Daniel S. DeStio of Pittsburgh. Dr. DeStio expressed the Association's appreciation of the dinner given by the Academy and welcomed the guests present. These included Academy guests: Dr. Dean M. Lierle of Iowa City, Academy Secretary for Instruction in Otolaryngology and Maxillofacial Surgery; Dr. Thomas D. Allen, Chicago, Councillor; and Dr. J. R. Fitzgerald, Chicago. Each secretary was asked to rise, give his name and the society which he represented. Forty members were present from all parts of the United States, Canada and South America.

Dr. Moacyr E. Alvaro, Sao Paulo, Brazil, made his report from South America. He had translated into Spanish various local society programs and sent them to the secretaries in his group. He had also translated and sent to them many suggestions on how to improve the local eye, ear, nose and throat societies. This information was well received. Dr. Alvaro commented very favorably on the programs by the Reading, Pa., and Kansas City, Mo., societies especially. He suggested that local eye, ear, nose and throat societies be encouraged to re-elect their secretary for at least five years or more if he is an efficient one.

Dr. Lierle expressed his appreciation and that of the Academy for receiving the reports of constructive criticism of the various instruction courses given each year by the Academy. These reports were made possible by the work of our Association's local secretaries, who saw to it that members who took courses made critical reports which were later sent to Dr. Lierle. He explained that this work aided the Academy a

great deal in selecting good men to present the courses and the subjects that were interesting to those taking the courses. He suggested that we report any new talent in our several communities and also any new subject matter thought advisable for presentation in the courses. It was brought out by Dr. Lierle that there was a greater increase in interest in the ophthalmology courses than in the otolaryngology courses and that some of the best courses go begging. He asked for suggestions by our secretaries on how to prevent these situations. These constructive criticisms will prove very helpful to the instructors who give the courses and, in turn, to the men who take them. Dr. Lierle stated that the survey of the courses given at the Academy should be continued again this year.

Dr. DeStio assured Dr. Lierle that the Association would be glad to carry on the survey another year and that forms would be sent as soon as possible to all secretaries of local eye, ear, nose and throat societies, who would see that they were distributed to their members and then sent back to Dr. DeStio.

Dr. Allen, representing the Academy Council, thanked the members for their co-operation with the Academy and congratulated them on the progress that they have made in their organization.

Dr. Fitzgerald suggested that local eye, ear, nose and throat societies report, through their secretaries, to Dr. DeStio what action had been taken by them in the matter of rebates and how this subject had been handled. He thought this information would be of help to other local societies.

Dr. DeStio brought up the subject of preparing a booklet on the etiquette of guest speakers and medical societies. It was agreed that printing such a booklet would be worth while. Dr. Lester A. Brown, the president-elect, volunteered to compile the booklet. All suggestions for this purpose are to be sent directly to him at 37 Doctors' Building, Atlanta, Ga., or to Dr. DeStio, Highland Building, Pittsburgh. It is planned to have the booklet ready to present at the 1950 annual meeting of the Association.

The nominating committee, consisting of Dr. Sam Sanders, Dr. Paul Craig and Dr. Edley Jones, made its report. Dr. Kenneth L. Craft, Indianapolis, the retiring secretary of the Association, was nominated president-elect; Dr. Daniel S. DeStio, Pittsburgh, was nominated secretary-treasurer; and Dr. H. L. Goss, Seattle, representing the Puget Sound Academy of Ophthalmology and Otolaryngology, was nominated director of district 8 to replace Dr. Barton E. Peden. No further nominations were made and these men were declared unanimously elected.

Dr. Edley Jones of Vicksburg, Miss., made a motion that a committee be appointed to express the sympathies of every member of the Association to Dr. Kenneth Craft, our secretary, on the very recent loss of his beloved wife. The president appointed Dr. Jones and Dr. Alvaro as members of such a committee to send our message to Dr. Craft.

The president, Dr. DeStio, then presented Dr. Ralph Pino of Detroit, the guest speaker of the evening. Dr. Pino has been very active in the work of the Michigan State Medical Society on medical economic problems. He is an authority in this field. He presented a most interesting and illuminating discourse on "Government Problems in the E.E.N.T. Field." The paper was very well received by all present.

The meeting was adjourned.

DANIEL S. DESTIO, M.D.
Secretary-Treasurer
Highland Building
Pittsburgh 6, Pa.

HOME STUDY COURSES

Application blanks for the 1950-1951 Home Study Courses may be secured from the Executive Secretary of the Academy, Dr. William L. Benedict, 100 First Avenue Building, Rochester, Minnesota. Registrations must be completed before August 15. The fee is $10.00.

Dr. Lawrence R. Boies is Secretary for Home Study Courses and Dr. Hendrie W. Grant is his associate in charge of the ophthalmology section. The subjects covered and the present faculties are listed below:

Ophthalmology

September ANATOMY AND EMBRYOLOGY	Raymond E. Meek John W. Anderson *C. Wilbur Rucker
October PHYSIOLOGY	Hendrie W. Grant George P. Guibor
November OPTICS AND VISUAL PHYSIOLOGY	Samuel D. Aiken Arthur Linksz *Frederick C. Cordes
December REFRACTION	Daniel Snydacker Frank W. Newell *Thomas D. Allen
January EXTERNAL DISEASES OF THE EYE	James H. Allen S. Rodman Irvine Samuel N. Key, Jr.
February PERIMETRY	John P. Macnie Wm. Banks Anderson
March EXTRAOCULAR MUSCLES	Conrad Berens Paul T. McAlpine
April OPHTHALMOSCOPY AND SLIT LAMP	P. J. Leinfelder Cecil W. Lepard
May PATHOLOGY	Michael J. Hogan John S. McGavic *Georgiana D. Theobald
June PHARMACOLOGY AND THERAPEUTICS	Kenneth C. Swan Alfred J. Kreft

*Consultant

Otolaryngology

September ANATOMY I and *October* ANATOMY II	Maurice F. Snitman J. Brown Farrior *O. E. Van Alyea
November HISTOLOGY	Leland G. Hunnicutt Frederick J. Pollock
December PATHOLOGY	Herman Semenov L. W. Dean, Jr.
January PHYSIOLOGY	Anderson C. Hilding William C. Thornell *Carl H. McCaskey
February BACTERIOLOGY	Ben H. Senturia Henry L. Williams *Jack E. Mulsow
March PHARMACOLOGY	Robert E. Priest Clifford F. Lake
April HEARING FUNCTION AND TESTING	George E. Shambaugh, Jr. Arthur L. Juers *Werner Mueller *Theodore E. Walsh
May VESTIBULAR FUNCTION AND TESTING	William J. McNally John R. Lindsay *H. C. Ballenger *Moses H. Lurie
June OTOLOGICAL ACOUSTICS	Scott N. Reger Clair M. Kos

INDUSTRIAL OPHTHALMOLOGY

INTRODUCTORY STATEMENT

Over the last 10 years it has become increasingly obvious that no effective eye program can be installed in any industry unless the cooperation of the professional consultants is complete enough to extend into meticulous refracting for exact work distances with meticulous measurements for frames, bifocal segments, pupillary distances, and all the other details so often very tiresome to the ophthalmologist. It is for this reason that the Joint Committee continues to hammer on this all important subject and is particularly delighted with the report that the Surgeon General of the Navy, Clifford A. Swanson, presented to the Academy membership.

It is the primary function of the ophthalmologist to examine completely and carefully and to prescribe, treat or operate in an effort to provide "best" vision for each individual to meet the visual demands made by the work that provides his livelihood. Nevertheless, this alone would not provide the ophthalmologist with an understanding of how important his contribution really is. Dr. A. K. Peterson, responsible for the health, well being and physical work potentials of the employees in a large printing plant, has focused our attention on the other end of this great project—properly correct vision. He has shown, by carefully analyzed and recorded facts, both the technic of setting up an eye program in industry and the results in black and white, dollars and cents, and amount of spoilage and work after every individual's vision has been corrected to meet the requirements of the job. Here again, it is important to remember that the connotation "for the job" is the key to success. Dr. Peterson's story speaks for itself.

It was felt that two of the several new projects recently initiated by the Joint Committee on Industrial Ophthalmology would be of interest to the general membership and therefore a brief summary of each of these is included.

The Joint Committee continues to secure from individual ophthalmologists informal simple statements of their experiences in varying types of industries. Only in this way can we accumulate information of benefit to the maximum number of ophthalmologists and to all types of industries.

HEDWIG S. KUHN, M.D.
Secretary, Joint Committee
Industrial Ophthalmology

HIGHLIGHTS OF THE NAVY EYE-CORRECTION, EYE-PROTECTION PROGRAM

REAR ADMIRAL C. A. SWANSON (MC) USN
WASHINGTON, D. C.

FROM the earliest times man has been concerned with the preservation of his vision, but all too often this concern has been manifested only after the damage has been done and the sight lost. In ancient Babylon, 42 centuries ago, King Hammurabi decreed, "If a man destroy the eye of another man, they shall destroy *his* eye." Insofar as the threat of punishment may have prevented wilful damage to Babylonian eyes, this law may be viewed as an early measure for control of eye injuries. Some 19 centuries later Aristotle touched upon the hazard of eye damage from flying particles, but he had no remedy to offer beyond the natural protection afforded by the eyelids. It has remained for the modern industrial age to make a dynamic approach to this problem and undertake its solution.

In viewing the problem of eye safety in industrial plants today it is at once apparent that more is involved than the hazard of direct injury to the eye by Aristotle's "flying particles." Accidents involving other parts as well as the eyes may be due to inadequate vision, which in turn may result from defective illumination as well as from a visual defect. A complete visual safety program must therefore be concerned not only with protecting the eyes from injury but in removal of the accident hazard associated with inadequate vision.

Surgeon General of the United States Navy.

The opinions or conclusions expressed in this paper are those of the author. They are not to be construed as necessarily reflecting the views or endorsement of the Navy Department.

Presented at the special scientific program of the Joint Committee on Industrial Ophthalmology, Oct. 9, 1949, Chicago, Ill.

The expansion which took place in Navy industrial facilities during the war years provided an urgent stimulus to the visual safety program. The need for accelerated production schedules directed attention to all factors involved in efficient operation, with the result that concerted efforts were made to improve illumination. By the judicious use of color, by the reduction of glare, and by fitting the intensity of lighting to the requirements of the work being done, plant illumination has been greatly improved. This program is an essential feature of the over-all visual safety program and is being continued and extended.

The direct protection of the eyes of workers in hazardous occupations has long been recognized as a management responsibility. Prior to the institution of the present eye-correction, eye-protection program this responsibility had been met in the Navy by the provision of appropriate safety devices and by supplying plano goggles. It has been found, however, that simple protective goggles are inadequate. Approximately 40 per cent of the naval civilian employees have refractive errors which require correction for adequate vision, and for these employees the use of simple protective goggles presents a problem. The worker is often faced with the dilemma of choosing between adequate vision and adequate protection.

The Seventy-ninth Congress enacted Public Law 604, which among other things provided means for implementing the Navy's eye-protection program. This law requires the Navy to supply corrective as well as protective lenses for workers in eye-hazardous occupations. Under this program a suitable protective goggle is supplied with the employee's correction ground into the lens, so that adequate protection and optimum vision are equally assured.

A Navy Department directive implementing Public Law 604 was promulgated in the fall of 1947, and the new program was inaugurated in November of that year. Within six months the program was under way in all naval industrial activities. Due to the scope of the program and variation in the availability of professional services and facilities for implementing it, some activities progressed faster than others. Consequently the program in some activities is not yet fully effective. Progress for the Navy as a whole, however, has been most gratifying both from the standpoint of reduction of eye injuries and in return of dollars and cents to management by reduction of compensation costs and payments.

Briefly stated the program covers five steps. First, the local safety board determines the areas, occupations, and specific jobs that are to be designated as hazardous. Second, all employees engaged in these hazardous occupations undergo a preliminary examination to determine their effective vision. Third, such of these as do not meet the visual requirements of the particular job with unaided eyes are referred for refraction. Fourth, goggles suitable to the occupation are supplied, embodying either a plano lens or the necessary correction. Fifth, all other employees, not in eye-hazardous occupations, are subjected to the preliminary visual examination, and those with apparently defective vision are advised to contact their own doctors, though not at government expense. Thus, all employees are given a preliminary visual examination, and those in eye-hazardous occupations or areas are supplied with protective goggles. When goggles are supplied, corrective lenses are included if refraction indicates the need.

Obviously the institution of such a program was a job of no mean proportions. With 304,000 civilian employees

in naval industrial facilities, the preliminary visual test alone is seen as a major undertaking, while the professional arrangements for refractions interposed a similar problem. I am not reporting a complete program, but you may judge our progress by the knowledge that more than 250,000 employees have had the preliminary examination, and more than 18,000 have been refracted.

The first step of the program is one of fundamental importance, since the evaluation of eye hazards determines the extent of the program. If hazards are overestimated the program becomes unduly cumbersome and expensive, while an underestimation of hazards defeats its purpose. The safety board, which makes these determinations, includes the medical officer, the safety engineer, and heads of the operating divisions of the activity. This function is a continuing one, since changes in production methods and new processes require re-evaluation of eye hazards.

While the job analysis undertaken by the safety board concerns itself with many other factors besides color, illumination, and necessary visual acuity required to perform the job at the machine, still the consideration of the elimination of eye hazards is a major component of the over-all study.

One of two devices, the Sight Screener and the Ortho-Rater, operated by personnel regularly employed in the safety section is used in the preliminary visual evaluation. The operators of these devices have been carefully selected by the medical officer and trained in the operation of the instruments by the manufacturers' representatives.

In the instance of doubt regarding the employee's adequacy of vision, investigation *on the job site* of the possible visual requirements furnishes the criteria for final evaluation.

Refraction is performed on those employees in hazardous trades whose inadequate vision has been disclosed by preliminary visual examination. These refractions are accomplished by qualified members of the eye-care profession selected from a panel previously approved by the industrial medical officer. Because of the isolated geographic location of some naval facilities, the limited availability of civilian professional personnel has occasionally necessitated the employment of military ophthalmologists and optometrists.

The fee for a refraction varies widely, though the majority range from $5.00 to $8.00. The cost per refraction has averaged $6.20. Some arrangements provide for the examination to be done in the doctor's office, while under other conditions facilities are provided by the Navy in a location convenient to the employees. Since the time lost from work by the employee being refracted is a charge against the program, it is usually more economical to have the work done in the naval facility, but the availability of professional services does not always permit this. In any event the examiner is required to familiarize himself with the working conditions and visual requirements for the specific tasks performed by the employee.

All of the lenses provided under this program are of the case-hardened, shatterproof type. The type of frame, however, varies widely, depending upon the protection indicated. Colored lenses are supplied when necessary. All corrective and protective goggles are supplied under contract with the various optical companies. Special problems require a wide variety of adaptations. For instance, when vision through a bifocal lens is cut off by a welding hood, the correction for near vision may be put in the aperture of the welding hood window.

Obviously the major effort and the greatest expense of the program is in its beginning, when *all* employees are subjected to preliminary visual examination and corrective-protective goggles are supplied to those in hazardous occupations. Once the initial phases are over, the program will be concerned principally with changes in hazardous conditions and changes in personnel. That stage has not been reached for the Navy as a whole, although some activities entered the maintenance phase of the program a year ago. I am therefore able to present the early results of the program in some of our activities.

FIGURE 1.

I will describe two activities in which I personally have had occasion to observe the progress of the program. Activity A employs more than 5000 persons who are engaged in a wide variety of trades. While the major function is concerned with production in metal working, including foundries, there are also important functions in research and maintenance unrelated to production activity. These diverse functions require varied methods of effecting the eye-correction, eye-protection program. In the maintenance functions particularly, the jobs undertaken from day to day require a constant reappraisal of visual hazards. In a production line, on the other hand, the evaluation of hazards can be made on a more stable basis, which favors increased effectiveness of the visual safety program.

Activity B employs about 1300 persons. The function of this plant is production in the metal working field, excluding foundries, and the bulk of its employees work at machine tools. In this activity the nature of work permits a more thorough appraisal of eye hazards than has been practicable in activity A.

In comparison with other naval activities the rate of eye injuries in activities A and B prior to the initiation of the present program was neither the highest nor the lowest. While their rates did not express the average for the entire Navy, they may be considered as reasonably typical.

At plant A during 1946 and 1947 there were on the average 12 lost-time

eye injuries for every million man hours worked. The new program was begun in February 1948, and for that year there were 7 eye injuries per million man hours. During the first half of 1949 there were slightly less than 5 eye injuries per million man hours. It cannot be questioned that these figures represent improvement. The question may be raised, however, as to the part played by the eye-correction, eye-protection program in achieving the improvement. It may be inferred that the program played a part, but in view of the many factors involved in the varied functions of activity A, it cannot be stated with assurance that the program is entitled to all of the credit. One important question is whether the employees wore the goggles that had been issued to them. On *that* factor depends the evaluation of the program. No matter what protective devices are provided for the eyes, they are useless in a tool box or pants pocket. The reason why protective spectacles are not worn when available is tied to a number of psychologic factors.

"You can lead a horse to water but you cannot make him drink." You can provide protective goggles, but getting them worn is another matter. There are, however, ways other than force for obtaining an objective (fig. 1). A better approach is expressed in the old adage, "Sow a thought, you reap an act; sow an act, you reap a habit."

From my own observation in activity A, the employees have not yet "reaped the habit" of constant use of their protective goggles. At plant B, however, that habit appears to have been deeply inculcated. It should be remarked that the program entered its maintenance phase earlier in activity B than in activity A. At activity B the wearing of protective goggles is so universal as almost to suggest a fetish, and one could get the impression that eye safety is being excessively emphasized. But the proof of the pudding is in the eating. Let me relate the experience at plant B.

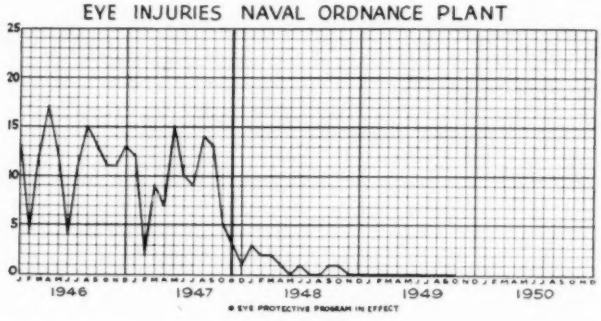

FIGURE 2.

In 1946-1947, prior to the new program, this activity had 58 eye injuries per million man hours worked. There were 232 injuries, of which 2 involved enucleation. During the first 10 months of the program there were 15 injuries, with a rate of 8 per million man hours. In the past 10 months, with *more than two million man hours worked, there has not been one single eye injury*. This is a record worth studying. Prior to the program this activity experienced 10 to 12 eye injuries per month; while the

program was being introduced this rate dropped to 1 per month; and for the 10 months since the program became fully effective, eye injuries have been completely avoided (fig. 2). Many factors must be studied in a detailed appraisal of this remarkable record, but it is impossible to escape the conviction that the implementation of the eye-correction, eye-protection program was the major factor involved. There have been in this plant, 15 documented instances in which serious eye injuries were avoided directly as a result of the program. In each case the protective spectacle was destroyed by flying pieces of metal without injury to the eye. The cases in which injury was avoided were not confined to machine operators but included persons standing or passing near the machine. For example, a broken drill smashed the protective lens worn by an individual 15 feet away from the drill press without injuring the eye (fig. 3).

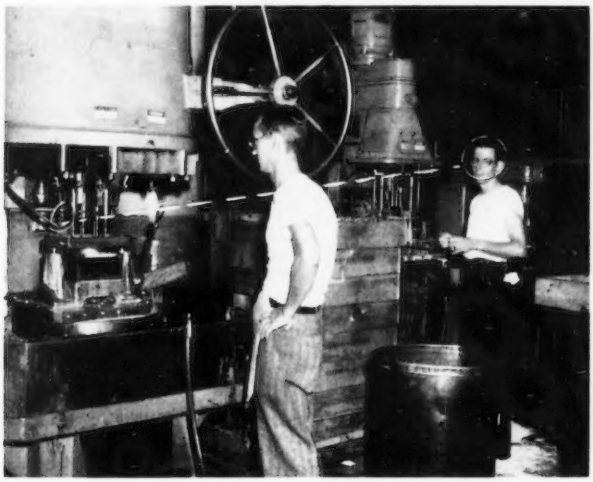

FIG. 3—A Natco multiple drill press with light 3/8 inch drills (production line job) galled (or stuck) in jig when hung on a piece of metal. The broken drill flew threw the air a distance of 14 feet and fractured the right lens of corrective-protective goggles worn by the operator of an adjoining machine. There was no injury except a small abrasion to the right cheek caused by the impact.

I hardly need point out that such examples of avoided eye injuries constitute excellent material for promoting acceptance of the program by the employees. Such examples emphasize the necessity of protecting not only the machine operator but also supervisors and any other persons who go into the hazardous area. If this seems to be carrying safety too far, remember that the plan has been 100 per cent effective in avoiding eye injuries in this plant. The end appears to justify the means (figs. 4, 5, and 6).

From these early results I believe you will agree that we have reason to be gratified with the success of the program to date.

The question may well arise as to the cost of the program to which we attribute such gratifying results. It would be confusing to attempt to study the over-all cost of the entire program, since it is in varied stages of completion at different activities and is thus not uni-

FIG. 4—An acting supervisor passed a radial drill press when a tap piece, 5/16 inch in size, hung on material and broke off, striking the left lens of the supervisor's corrective-protective goggles. No eye injury resulted.

formly effective throughout the Navy at this time. It was originally considered that as much as 15 years' savings in cost of eye injuries might be needed to amortize the cost of the program. The early results, however, suggest that the financial savings may be much greater than anticipated.

The average cost of an eye injury involving time lost from work has been $60.00. This figure does not include compensation for loss of an eye, but only the cost of medical care plus the cost of the employee's lost time while under treatment.

It has been shown that the eye injury rate at plant B prior to the inauguration of the program was 58 per million man hours. Since the eye-correction, eye-protection program was instituted 20 months ago, 217 fewer eye injuries have occurred than would have been expected if the previous rate had con-

FIG. 5—The operator of a turret lathe was using a 10 inch machine file incorrectly on a burring operation. The file struck the lathe chuck, causing the file to be thrown against the operator's face. The left lens of his corrective-protective goggles was broken causing a slight abrasion to the left forehead and cheek. There was no damage to the eye.

FIG. 6—A rotary sandblast machine, using ball shot about the size of BB shot, is used to knock off roughs on forgings. The shot broke the corrective-protective lenses of three different operators. This machine is equipped with a barrier guard that was not adequate. The safety engineer designed a secondary barrier guard for this machine that has proved effective to date.

tinued. The cost of these injuries at $60.00 each would have amounted to $13,000. On the other hand, the cost of the program to date, including refractions, corrective-protective glasses, and time lost from work to obtain refraction and fitting of glasses has amounted to only $9,500. In this instance it seems safe to say that the program has more than paid for itself in the first 20 months. The maintenance cost of the program will be very small in proportion to the initial outlay. Therefore the savings from avoided future eye injuries will be almost entirely net profit.

I should say that we do not anticipate results as favorable as this from every activity. The nature of operations in this particular shop is such as to facilitate control to an extent not practicable where activities are more diversified and employees are scattered in small groups over a wide area in varied occupations. The effectiveness of the program will depend upon developing the habit of wearing the protection, and the ease with which the habit is developed depends in part upon local operating conditions. Hence we can expect variation in the relative effectiveness of the program in different activities.

It will be interesting to study other factors in evaluating the results of the program, to determine the extent to which the general accident rate may be affected, and to observe the effect of improved vision on production. At this time, however, the program is not old enough to provide adequate data on which to base such studies, and our interest in these features must wait.

It is evident from our experiences over the past year that the present eye-correction, eye-protection program can be highly effective in reducing eye injuries. Furthermore, it appears that the cost of preventing eye injuries through this program will be less than the cost of treating the injuries, to say nothing of the humanitarian consideration of preserving eyesight. The program is another instance of an ounce of prevention being not only worth more than a pound of cure but actually costing less.

SELECTED REFERENCES

1940-1949

1. Allen, T. D. and Carman, H. F., Jr.: Protective equipment for eyes in industry, J.A.M.A., 116:1343-1348 (March 29) 1941.
2. Birren, Faber: The specification of illumination and color in industry, Tr. Am. Acad. Ophth., 51:242-251 (Jan.-Feb.) 1947.
3. ———: Illumination and color in industry, Sight-Saving Rev., 17:217-227 (Winter) 1947.
4. Farnsworth, Dean: Need for informative labeling of sun glasses, Tr. Am. Acad. Ophth., 52:366-370 (March-April) 1948.
5. Fleischer, W. E.: Ophthalmic effects of welding radiations, Tr. Am. Acad. Ophth., 51:667-671 (July-Aug.) 1947.
6. Kuhn, Hedwig S.: Industrial Ophthalmology, St. Louis, C. V. Mosby Co., 1944.
7. ———: Industrial ophthalmology as of 1946, J.A.M.A., 132:772-777 (Nov. 30) 1946.
8. Leedke, H. H.: The ophthalmologist and the industrial nurse, Tr. Am. Acad. Ophth., 51:230-236 (Jan.-Feb.) 1947.
9. Lo-Presti, J.: The Connecticut experience with eye problems in small industries, Tr. Am. Acad. Ophth., 49:298-303 (May-June) 1945.
10. ———: An eyesight survey of 30 plants, Sight-Saving Rev., 15:202-211 (Winter) 1945.
11. Mann, Ida: Scope of prevention in ophthalmology, Brit. M. J., 2:482-483 (Oct. 16) 1943.
12. McBride, E. D.: Disability Evaluation, ed. 4, Philadelphia, Lippincott, 1948, chap. 32, Injuries of the Eye, pp. 575-595.
13. Roche, J. M. and Kuhn, H. S.: Industrial eye protection practice, Tr. Am. Acad. Ophth., 51:675-681 (July-Aug.) 1947.
14. Saunders, E. E.: Navy eye-correction, eye-protection program, Tr. Am. Acad. Ophth., 52:562-565 (May-June) 1948.
15. Snell, A. C.: Industrial eye problems and ophthalmologists, Tr. Am. Acad. Ophth., 51:103-106 (Nov.-Dec.) 1946.

16. Snell, A. C., Culler, A. and Kuhn, H. S.: Field of industrial ophthalmology: report by Committee on Industrial Ophthalmology of Section on Ophthalmology of the American Medical Association, J.A.M.A., 118:610-613 (Feb. 21) 1942.

17. Snell, A. C. et al: Proceedings of a Conference on Industrial Ophthalmology Sponsored by the Columbia University College of Physicians and Surgeons in Cooperation with the National Society for the Prevention of Blindness, May 7-11, 1945, New York, Columbia University Press, 1947.

18. Swanson, C. A. and Stewart, R. A.: Causes of uniocular and binocular blindness in the U. S. Navy and U. S. Marine Corps in World War II, U. S. Nav. M. Bull., 46:520-527 (April) 1946.

19. Tiffin, Joseph: Industrial Psychology, ed. 2, New York, Prentice-Hall, Inc., 1947.

20. Townsend, J. G.: Problems in industrial ophthalmology, Tr. Am. Acad. Ophth., 48: 202-204 (Jan.-Feb.) 1944.

PRELIMINARY REPORT OF PROGRESS OF THE EYE PROGRAM AT R. R. DONNELLEY & SONS

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Frank Noetling, S.B.
CHICAGO, ILL.

As an industrial physician and the medical director of one of the country's largest printing companies, we deem it a distinct opportunity to acquaint members of the American Academy of Ophthalmology and Otolaryngology with our industrial eye program.

About two and a half years ago top management of our company had a conference with a well-known consulting industrial ophthalmologist who explained and showed them a means of improving production and employee well-being by the correction of visual defects and the application of visual job standards. This management was progressive in its thought and set aside a fund to survey one large department in order to observe the results of visual correction in certain critical jobs—a pilot project later developed into a uniform eye program for the plant as a whole.

It is obvious that good eyesight, and particularly good corrected eyesight, is essential in the printing industry, for production of high quality printing necessitates accuracy based on visual excellence. The department selected to prove to management the results of proper eyesight correction was our department A, which consists of compositors, linotype operators, monotype keyboard operators, lock-up men, and proofreaders. Testing was done by appointment, using the Bausch & Lomb Ortho-Rater. Co-operation was entirely voluntary and there was no difficulty in getting employees to take the tests.

All persons tested, regardless of their visual acuity, were rated by their foreman as to job efficiency. The efficiency index of each employee's productivity was also used to give us a work-rating. There was a distinct and definite correlation between those employees who were and those who were not corrected, as shown in the accompanying 10 figures.

After the data were gathered together management could readily see that visual correction was important. Our consulting ophthalmologist then evaluated those employees with subminimal vision, and they were corrected in accordance with the job standards set up by Purdue University. Results in increased efficiency and lowering of spoilages were so evident that management authorized a complete vision program for the entire company. This program has just been completed after two years of testing and correction in accordance with job standards.

The senior author is medical director of R. R. Donnelley & Sons.

Revised and enlarged from a paper entitled "Before and After an Industrial Eye Program in the Printing Industry" presented at the special scientific program of the Joint Committee on Industrial Ophthalmology, Oct. 9, 1949, Chicago, Ill.

In the printing industry there is, of course, special need for a good color test in order to check color discrimination in employees who handle color printing. In this group would be included salesmen, pressmen, artists, and photographers. At the recommendation of our consulting ophthalmologist, we procured the Farnsworth-Munsell 100-Hue Color Discrimination Test. This seems to meet, more completely than other color tests, our needs for color testing. One must bear in mind that the Farnsworth-Munsell test is not a test for color blindness but rather for the fine discrimination of color hues. In our experience we found very few persons in the critical jobs listed above who were subnormal in their color discrimination. Those who had poor color discrimination were readily detected by the scoring and charting system which is used in the Farnsworth-Munsell test.

The following report is based on visual studies conducted with 336 employees in department A of this printing plant and includes most of the major occupational groups in the department.

The eye program is carried out by the medical department taking into consideration the general pattern of placement as worked out in the employment department and the special needs of the training division interested in the careful eye study of apprentice candidates. Working closely also with the medical director on problems of record interpretation, pathology, and the corrective program is our consulting ophthalmologist. The degree of importance that vision has to performance on the job is illustrated in figures presented here.

1. Proof readers who meet the minimum visual requirements are 37 per cent more accurate than those who fail to meet the minimum visual requirements. They have 7.9 points higher efficiency and produce a net productive value of 12 cents per man per hour more than those who fail to meet the minimum visual requirements.

2. Compositors who meet the minimum visual requirements have 5.5 points higher efficiency and produce a net productive value of 25 cents per man per hour more than those who fail to meet the minimum visual requirements.

3. No data have as yet been compiled for lock-up men.

4. Monotype keyboard operators who meet the minimum visual requirements have 19.1 points higher efficiency and produce a net value of 71 cents per man per hour more than those who fail to meet the minimum visual requirements.

5. No data have as yet been compiled for linotype operators.

6. Monotype runners who meet the minimum visual requirements have 9.8 points higher efficiency and produce a net value of 8 cents per man per hour more than those who fail to meet the minimum visual requirements.

DISCUSSION AND CONCLUSIONS

Vision has a high relationship to success on these jobs and is important for quality, production, and over-all efficiency.

In our experience over 90 per cent of the persons who rated below the minimum visual requirements can receive adequate correction with professional treatment. Therefore, it was possible to bring most of the virtually substandard group up or beyond the minimum visual requirements. As a result, the quality production and over-all efficiency of the visually substandard group was expected to increase substantially. For example:

1. Proofreaders in the visually *substandard* group now make .217 more errors (demerits) per standard hour than those in the group which meets the minimum visual requirements. If 90 per cent of this substandard group receive adequate visual correction and thus make fewer errors, the difference in

errors per standard hour between the groups will be .048 rather than .217. This group, therefore, will be 78 per cent more accurate than it is now.

2. A compositor who *meets* the minimum visual requirements produces 25 cents net productive value per hour more than the visually handicapped compositor. This is $9.38 per man per week, or $487.76 per man per year for those in the group which meets the minimum visual requirements. If we recall that over 90 per cent of the visually substandard group can receive adequate correction, then this group would theoretically produce an additional new productive value per man of $438.98 (90 per cent of $487.76) per year after visual correction. If we were to estimate the possible increase in production resulting from visual correction of the visually substandard group as conservatively as 50 per cent rather than 90, the average person in that group would produce an additional net productive value of $243.88 per year after receiving correction. The exact production is in process of compilation.

3. A monotype keyboard operator who *meets* the minimum visual requirements produces 71 cents net productive value per hour more than the visually substandard operator. This is $26.63 more per week per man; or $1,384.00 more per year per man for those in the group which passed the minimum visual requirements. If we recall that over 90 per cent of the visual substandard group can receive adequate correction, then this group could theoretically produce an additional new productive value per man of $1,246.60 (90 per cent of $1,384.00) per year after visual correction. If we were to estimate the possible increase in production resulting from visual correction to the visually substandard group as conservatively as 50 per cent rather than 90 per cent, the average person in that group would produce an additional new productive value of $692.00 per year after receiving correction.

Obviously, the best professional attention should be given to the scientific appraisal of visual skills and to the correction of all that can be corrected among those not meeting *minimum standards.*

The sum total savings in terms of spoilage (paper, inks, man hours, customer satisfaction) in this one department of 336 employees in a plant of over 2000 employees was found to be $6,000 a month.

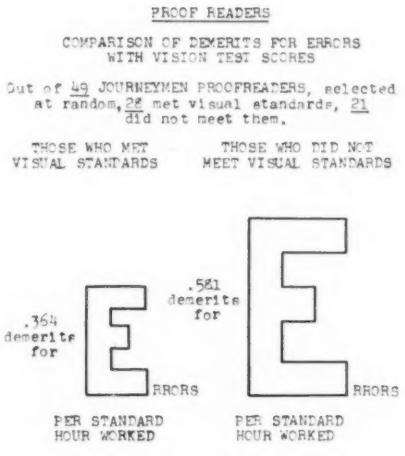
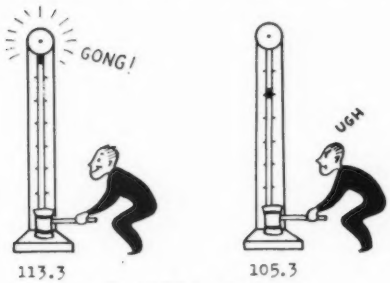

PROOF READERS
COMPARISON OF DEMERITS FOR ERRORS WITH VISION TEST SCORES
Out of 49 JOURNEYMEN PROOFREADERS, selected at random, 28 met visual standards, 21 did not meet them.
THOSE WHO MET VISUAL STANDARDS
THOSE WHO DID NOT MEET VISUAL STANDARDS
.364 demerits for
ERRORS
PER STANDARD HOUR WORKED
.561 demerits for
ERRORS
PER STANDARD HOUR WORKED
PROOF READERS below the minimum visual requirements make .217 MORE ERRORS (demerits) per man than those who meet the minimum visual requirements. 60% more errors are made by those who are below the minimum visual requirement.

FIGURE 1.

PROOF READERS

COMPARISON OF EFFICIENCY RATINGS WITH VISION TEST SCORES OF 49 JOURNEYMEN SELECTED AT RANDOM



TRI-MONTHLY EFFICIENCY RATING

THOSE WHO MET VISUAL REQUIREMENTS (28 PERSONS)	THOSE BELOW VISUAL REQUIREMENTS (21 PERSONS)

PROOF READERS who meet the minimum visual requirements have 7.9 points higher efficiency on the average than those below the minimum visual requirements.

FIGURE 2.

PROOF READERS

COMPARISON OF FOREMEN'S RATINGS AND VISION TEST SCORES 59 JOURNEYMEN SELECTED AT RANDOM

THOSE WHO MET VISUAL STANDARDS (29 PERSONS)

65-1/2% RATED ABOVE AVERAGE BY FOREMEN

34-1/2% RATED BELOW AVERAGE BY FOREMEN

THOSE BELOW VISUAL STANDARDS (24 PERSONS)

33-1/3% RATED ABOVE AVERAGE

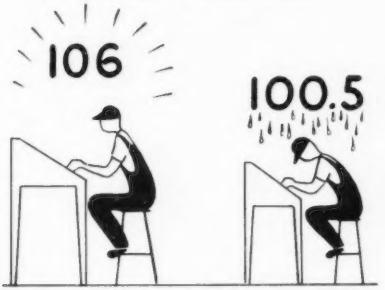
66-2/3% RATED BELOW AVERAGE

PROOF READERS who MEET the minimum visual requirements were rated above average by their foremen in TWO OUT OF THREE CASES and proof readers BELOW the minimum visual requirements were rated below average by their foremen in TWO OUT OF THREE CASES.

FIGURE 3.

COMPOSITORS

COMPARISON OF EFFICIENCY RATINGS WITH VISION TEST SCORES (TRI-MONTHLY EFFICIENCY RATINGS)



THOSE WHO MEET VISUAL REQUIREMENTS EARNED AVERAGE TRI-MONTHLY EFFICIENCY RATINGS OF 106	THOSE BELOW VISUAL REQUIREMENTS EARNED AVERAGE TRI-MONTHLY EFFICIENCY RATINGS OF 100.5

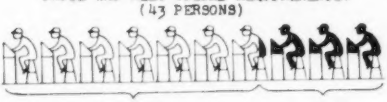
COMPOSITORS who MEET the minimum visual requirements have 5.5 POINTS HIGHER EFFICIENCY on the average than those below the minimum visual requirements.

FIGURE 4.

COMPOSITORS

COMPARISON OF FOREMEN'S RATINGS WITH VISION TEST SCORES (66 JOURNEYMEN SELECTED AT RANDOM)

THOSE WHO MEET VISUAL REQUIREMENTS: (43 PERSONS)



67-1/2% RATED ABOVE AVERAGE BY FOREMEN

32-1/2% RATED BELOW AVERAGE BY FOREMEN

THOSE BELOW VISUAL REQUIREMENTS: (23 PERSONS)

26% RATED ABOVE AVERAGE BY FOREMEN

74% RATED BELOW AVERAGE BY FOREMEN

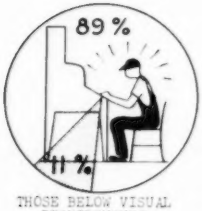
COMPOSITORS who MEET visual requirements were rated above average by their foremen in TWO OUT OF THREE CASES.

COMPOSITORS BELOW the minimum visual requirements were rated below average by their foremen in THREE OUT OF FOUR CASES.

FIGURE 5.

LINOTYPE OPERATORS

COMPARISON OF FOREMEN'S RATINGS WITH VISION TEST SCORES (23 JOURNEYMEN SELECTED AT RANDOM)



THOSE WHO MEET VISUAL REQUIREMENTS

RATED ABOVE AVERAGE 88%

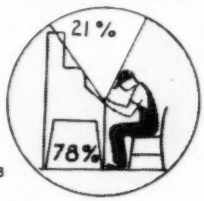
RATED BELOW AVERAGE 11%

LINOTYPE OPERATORS who MEET minimum visual requirements were rated above average in NINE CASES OUT OF TEN

THOSE BELOW VISUAL REQUIREMENTS

21-1/2% RATED ABOVE AVERAGE

78-1/2% RATED BELOW AVERAGE

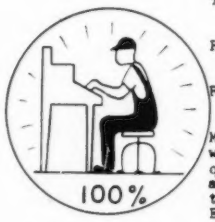


LINOTYPE OPERATORS BELOW the minimum visual requirements were rated below average in FOUR CASES OUT OF FIVE.

FIGURE 6.

MONO-KEYBOARD OPERATORS

COMPARISON OF FOREMEN'S RATINGS AND VISION TEST SCORES (15 JOURNEYMEN SELECTED AT RANDOM)



THOSE WHO MEET VISUAL REQUIREMENTS:

RATED ABOVE AVERAGE 100%

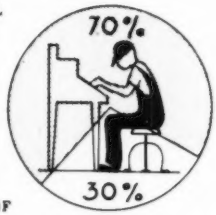
RATED BELOW AVERAGE 0%

MONOTYPE OPERATORS who MEET visual requirements were rated above average by their foremen in EVERY CASE.

THOSE BELOW VISUAL REQUIREMENTS

30% RATED ABOVE AVERAGE

70% RATED BELOW AVERAGE



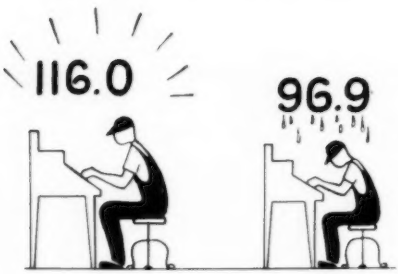
MONOTYPE OPERATORS BELOW the minimum visual requirement were rated below average in TWO OUT OF THREE CASES!

FIGURE 8.

MONOTYPE KEYBOARD OPERATORS

COMPARISON OF EFFICIENCY WITH VISION TEST SCORES

(16 JOURNEYMEN SELECTED AT RANDOM)



THOSE WHO MEET VISUAL REQUIREMENTS AVERAGE TRIMONTHLY EFFICIENCY RATINGS OF 116.0

THOSE BELOW VISUAL REQUIREMENTS AVERAGE TRIMONTHLY EFFICIENCY RATINGS OF 96.9

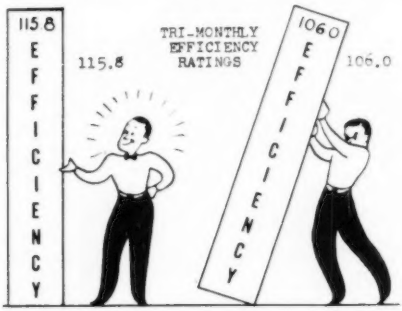
MONOTYPE KEYBOARD OPERATORS who meet the minimum visual requirements have 19.1 points higher efficiency, on the average, than those below the minimum visual requirements.

FIGURE 7.

MONOTYPE CASTING MACHINE OPERATORS

COMPARISON OF EFFICIENCY RATING WITH VISION TEST SCORES

(11 EXPERIENCED RUNNERS SELECTED AT RANDOM)



THOSE WHO MEET VISUAL REQUIREMENTS (5 PERSONS)

THOSE BELOW VISUAL REQUIREMENTS (6 PERSONS)

MONO RUNNERS who MEET the minimum visual requirements have 9.8 points higher efficiency than those BELOW minimum visual requirements.

FIGURE 9.

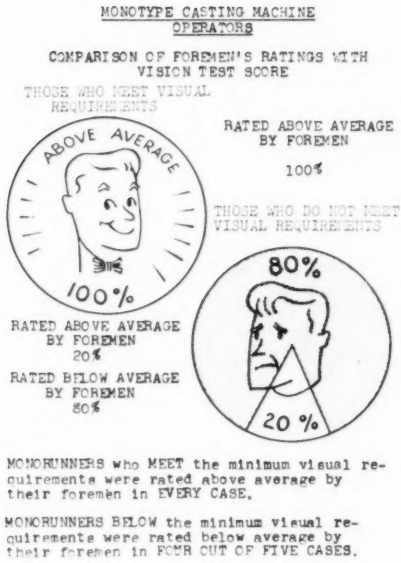

MONOTYPE CASTING MACHINE OPERATORS
COMPARISON OF FOREMEN'S RATINGS WITH VISION TEST SCORE
THOSE WHO MEET VISUAL REQUIREMENTS
RATED ABOVE AVERAGE BY FOREMEN
100%
ABOVE AVERAGE
100%
RATED ABOVE AVERAGE BY FOREMEN 20%
RATED BELOW AVERAGE BY FOREMEN 80%
THOSE WHO DO NOT MEET VISUAL REQUIREMENTS
80%
20 %
MONORUNNERS who MEET the minimum visual requirements were rated above average by their foremen in EVERY CASE.
MONORUNNERS BELOW the minimum visual requirements were rated below average by their foremen in FOUR OUT OF FIVE CASES.

FIGURE 10.

SECOND INJURY FUND LAWS

DUE to the variation and complexities of state laws involving compensation to the workman sustaining permanent loss of vision, the Joint Committee is often consulted concerning the status of individual cases and problems. The loss of the second eye of a worker already blind in one eye means total loss of man—a costly type of compensation. If the total cost of such compensation is imposed upon the latest employer, such one-eyed workers often are refused employment. By the creation of second injury funds, by law, all employers pool a certain sum. A "total man" is then provided for from this pool. Many states now have second injury funds. The exact method of financing the second injury fund differs in the various states. It is important for every ophthalmologist to have exact information regarding his own state laws and also to be familiar with the over-all picture. Only in this way can he advise the patient, industry, and insurance companies how to proceed in fairness to all according to law.

In some states, waiver clauses have been set up instead of second injury funds. The waiver clause can be and is, in some instances, improperly worded so as to be no law at all. In other states it is correctly worded and can be depended on.

The Joint Committee, assisted by authorities, is compiling all information with reference to both types of legislation.

DIRECTORY OF OPPORTUNITIES FOR REHABILITATING THE BLIND

THE opportunity to aid in the rehabilitation of the blind has perhaps not been fully realized by the average ophthalmologist. Those of us practicing in industrial areas have a real responsibility as well as an opportunity. In the strict sense of the word, the predicament of the blind is a personal or a social problem; however, an individual who is newly blinded would benefit greatly if co-operation between his doctor and agencies for rehabilitation were more closely maintained. So often the handicapped person fails to make the proper contacts until his attitude toward blindness is such that he despairs of the possibility of ever returning to normal activity. The doctor who has treated the patient is usually in possession of many of the facts in the private life of the individual, having a history of past employment, financial status, educational background, and physical impairments other than blindness. He is thereby in a position to judge rehabilitation possibilities.

Many agencies have been set up to meet the need, many are taxed to full capacity, and some are duplicated unnecessarily. States meet their problem with facilities that are either private or tax supported, and each state's program is different from the others.

The Joint Committee has undertaken the task of producing a directory of information which will list (1) tax-supported institutions for the blind, their costs, admission requirements, etc.; (2) private institutions; (3) schools for academic or vocational training and pertinent information regarding them; (4) laws of state with reference to hiring the blind or partially blind; and (5) industries or businesses hiring the blind.

Such a directory will provide practical information immediately accessible to the ophthalmologist and his patient. Questionnaires already sent out to Academy members show that a large proportion of doctors are anxious to have this information. The state medical associations are co-operating with us in accumulating these facts. Any suggestions of additional information which would be of value in such a directory will be appreciated.

CONTINUING BIBLIOGRAPHY ON INDUSTRIAL EYE PROBLEMS

AGARWALL, R. S.: *Eyesight under adverse conditions*, Antiseptic, 45:461-464 (July) 1948; (Abstr.) Quart. Rev. Ophth., 5:145 (June) 1949.

ANON.: *Training the blind for open and sheltered employment*, Brit. J. Phys. Med., 12:48 (March-April) 1949.

BARTLEY, S. H.: *The basis of visual fatigue*, Am. J. Optom., 24:372-384, 1947.

CHAPMAN, A. L.: *The public health worker in conservation of vision for old age*, Sight-Saving Rev., 10:3-10 (Spring) 1949.

DORMAN, P.: *Sight restoration in a school for the blind*, Am. J. Ophth., 32:433-436 (March) 1949.

FITZGERALD, J. R.: *Causes of blindness in Illinois*, Sight-Saving Rev., 19:35-40 (Spring) 1949.

HUMPHREY, DONALD R.: *The smaller plant: compulsory eye protection for the small plant, too*, Nat. Safety News, April 1949, pp. 35, 36, 50.

LUDVIGH, ELEK J.: *Visual acuity while one is viewing a moving object*, Arch. Ophth., 42:14-22 (July) 1949.

HANMAN, BERT: *Occupational incapacity: can this dilemma in workmen's compensation be overcome?* Indust. Med., 17:383-402 (Oct.) 1948.

IMUS, H. A.: *Industrial vision technics*, Am. J. Ophth., 32:145-152 (June) 1949.

MANUS, LEO: *When does visual discomfort arise?* Optom. Weekly, 40:443-445 (March 24) 1949.

MERCIER, A.: *The rationale of the visual standards of certain security occupations*, Ann. d'ocul., 182:24-31 (Jan.) 1949; (Abstr.) Ophth. Lit., 3:960 (Sept.) 1949.

MUNROE, W. A.: *New Jersey pushes a new program to conserve its workers' sight*, Indust. Hyg., 9:5-6 (June) 1949.

REYNOLDS, GLEN R.: *V. A. training of blinded veterans in Indiana*, Outlook for Blind and Teachers Forum, 43:7-11 (Jan.) 1949.

SOULE, T. H.: *Social and family problems of eye patients*, Sight-Saving Rev., 19:35-40 (Spring) 1949.

WILSON, J. F.: *Adjustment to blindness*, Brit. J. Psychol., 38:218-226, (June) 1948; (Abstr.) Ophth. Lit., 2:550 (March) 1949.

BOOK REVIEWS

Public School Audiometry: Principles and Methods

By Loraine Anson Dahl. Danville, Ill., The Interstate Printers, 1949. 290 pages.

This is an excellent and timely book. Because of its clarity, conciseness and freedom from technical jargon, it is one that is likely to be read widely by lay persons interested in the problems of conservation of hearing.

Fortunately the material is of wider applicability than might be supposed from the title, applying to audiometry in adults as well as to deafness in any child of school or preschool age and in any school whether public or private.

The material is divided into three sections. The first is an eloquent plea for the establishment of conservation of hearing programs in schools together with an estimate of the magnitude and importance of the problem of deafness in children. The second section is devoted to the technics of making the community "hearing conscious" and a proposal to put the problems of deafness in children under state (not federal) control. The third section, comprising about half the book, is devoted to the technics and principles of audiometry. In addition, there is a useful appendix covering for the most part well thought out forms for the recording of findings. The book is completed by an excellent bibliography and a thorough index. The book justifies the statement in the editor's foreword that it is distinctive on two counts: (1) it provides background content expertly selected and presented in such a way as to make audiometric testing come alive, and (2) it presents with cookbook thoroughness and practicability minutely detailed instructions for hearing testing.

Although prepared as a textbook and field manual for students in training and for professional audiometric technicians, it would be a valuable addition to the working library of any physician interested in audiometry.

Henry L. Williams, M.D.

Ophthalmic Medicine

By James Hamilton Doggart, M.D., F.R.C.S. Philadelphia and Toronto, The Blakiston Co., 1949. 87 illustrations, 28 color plates, 329 pages. $8.00.

The intent of the author of this book is indicated by the title "Ophthalmic Medicine" inasmuch as he makes a different approach to *medical ophthalmology* than that appearing in numerous available texts. The subject matter is not unfamiliar, but the manner of presentation gives a fresher outlook and an interesting viewpoint that make the understanding of the relation between eye disease and manifestations of the disease elsewhere in the body a bit more comprehensive. The first four chapters, "The History of a Case," "Symptoms," "Methods of Examination," and "Physical Signs," are written in a style typically British and reminiscent of Carter and Allbutt. The 300 pages of text are divided into 35 chapters dealing with signs and symptoms of general diseases and the ocular changes incident to extension, metastasis, severity and chronicity. A handbook of ready medical references, it deserves a place on every ophthalmologist's desk. It is adequate for quick review and for reminding one of things that may be uncertain in memory. Illustrations are excellent in reproduction and are well selected.

William L. Benedict, M.D.

POSITIONS AVAILABLE

Retiring after 50 years of practice in Wisconsin and California. Have good equipment in good office rooms which I would like to sell to a good eye, ear, nose and throat man, or to an ophthalmologist and an otolaryngologist who will work in association. Write to V. A. Chapman, M.D., Carnell Building, North Palm Canyon Drive at Andreas Road, Palm Springs, Calif.

The staff of the **Lewistown Hospital**, Lewistown, Pa., is interested in having a man certified in both ophthalmology and otolaryngology locate in Lewistown. One of the two certified men on the active staff will retire soon, and both men agree that a third is needed at once. If unable to find someone certified in both fields, they would prefer someone certified in otolaryngology. Lewistown Hospital serves a prosperous agricultural area with a population of approximately 75,000. New construction is now under way which will give them a total of 186 beds plus 56 newborn bassinets. Write to Mr. Robert A. Kumpf, Administrator, Lewistown Hospital, Lewistown, Pa.

Wanted: Ophthalmologist, diplomate or Board eligible, young, well-trained, as associate in private practice. For further information, write Drs. Gaines and Warder, Professional Building, Anderson, S.C.

Listings of positions available should be sent to W. L. Benedict, M.D., 100 First Avenue Building, Rochester, Minn., by the fifth of the month preceding publication. They should include (1) type of physician wanted (ophthalmologist or otolaryngologist; diplomate, resident, etc.); (2) type of position to be filled; and (3) whom to write for further information. Unless otherwise requested, listings will be published once only.

The Academy will handle no further correspondence beyond the listing and assume no responsibility. Neither does it endorse or guarantee any of the published listings.

Wanted: Certificated ophthalmologist, or one well qualified who is eligible and intends to secure Board certificate. Jackson Clinic, 16 South Henry Street, Madison 3, Wis.

The Veterans Hospital of Dayton, Ohio, is desirous of obtaining a full-time resident ophthalmologist who has been certified by the American Board of Ophthalmology.

This hospital of 750 beds (with additional tuberculosis hospital and domiciliary patients) is affiliated with the College of Medicine of the University of Cincinnati and is staffed and directed to a great extent by the faculty of that institution.

If interested please reply to: Donald J. Lyle, M.D., Senior Consultant in Ophthalmology, 601 Union Trust Building, Cincinnati 2, Ohio.

Wanted: Young otolaryngologist to fill position of associate. Board certification or equivalent training required. Will accept young man having basic requirements for Board certification and complete training for Board. Head department in few years. Good salary. For further information write to Lyman A. Copps, M.D., Marshfield Clinic, Marshfield, Wis.

Wanted: Well qualified otolaryngologist to join office of three men well established in eye, ear, nose and throat work. Expansion has become necessary because of illness of one member. For further information write Dr. Charles F. Leich, 124 First Street Southeast, Evansville, Ind.

Otolaryngologist: A position for a resident otolaryngologist is available in the office of Dr. Otto C. Hirst, 3601 Stokley Street, Philadelphia 29, Pa.

News - - - Notes

INTERNATIONAL CONGRESS OF OPHTHALMOLOGY

The Sixteenth International Congress of Ophthalmology will be held in London July 17-21, 1950. It is hoped to arrange a full academic program and also various social functions. During the week preceding the Congress there will be meetings in Edinburgh for those who wish to attend and several excursions to the surrounding countryside. Excursions are also planned to Cambridge and Canterbury on July 22 and to Oxford from July 22 to 25.

The secretaries of the national ophthalmologic societies have been circularized and asked to send a list of their members for individual notification. Should any association not receive this letter, they should communicate with the Secretary-General, Mr. Frank W. Law, M.D., F.R.C.S., 45 Lincoln's Inn Fields, London, W.C. 2.

AMERICAN BOARD OF OPHTHALMOLOGY

Candidates for the certificate of the American Board of Ophthalmology are accepted for examination on the evidence of a written qualifying test. These tests are held annually in various parts of the United States.

Applications are now being accepted for the 1951 written test. They will be considered in order of receipt until the quota is filled. Practical examinations for acceptable candidates will be held on the following dates: Boston, May 22-26, 1950; Chicago, Oct. 2-6, 1950; West Coast, January 1951.

A new directory of all diplomates to date, arranged alphabetically and geographically, will be published early in 1950. No biographical material will be included. Diplomates are urged to keep the Board office informed of all changes of address.

THE AMERICAN ORTHOPTIC COUNCIL

The American Orthoptic Council is announcing the third annual training course for orthoptic technicians. This course was previously given in Maine in 1948 and in Boston in 1949. The current course will begin in Boston on July 5, 1950. The didactic portion of the course will last through August 30, the tuition fee being $150 and room and board $100. The practical portion of the course will be given in various teaching clinics and offices throughout the country during the succeeding year. Nationally known ophthalmologists and certified orthoptic technicians will aid Dr. Walter B. Lancaster with the didactic instruction. Scholarships for worthy students may be available. Contact the office of the American Orthoptic Council, 1605 Twenty-second St., N.W., Washington 8, D. C., for further information concerning the course. Deadline for receiving applications is July 1, 1950.

THE ASSOCIATION FOR RESEARCH IN OPHTHALMOLOGY

The annual meeting of the Association for Research in Ophthalmology, Inc., will be held June 24 and 25, the two days preceding the meeting of the American Medical Association, in San Francisco.

The Eastern Section meeting of the Association for Research in Ophthalmology was held in New York on January 28. Papers were read by Dr. John Locke, "Cytological and Bacteriological Studies on the Aqueous Humor in Uveitis"; Dr. Ervin Tusak, "Experimental Tissue Therapy in Selected Ophthalmological Disorders"; Dr. Frederick Williams, "Alkali Resistant Polysaccharides of the Retina"; Drs. Frederick Merriam and Y. E. Kinsey, "Synthesis of Glutathione in Normal and Cataractous Lens"; Drs. R. H. Peckman and R. D. Harley, "Reduction of Visual Acuity Resulting from Exposure to Sunlight"; Dr. Andrew de Roetth, "Choline Acetylase Activity in Ocular Tissues"; Dr. Arthur B. Duel, Jr., "Clinical and Experimental Observations of Cycloelectrolysis and Cyclodiathermy"; and Drs. John McLean and Daniel Gordon, "Studies in ACTH in Eye Diseases."

THE NATIONAL SOCIETY FOR THE PREVENTION OF BLINDNESS

A $500,000 budget for an intensified campaign against preventable blindness was adopted as the 1950 objective of the National Society for the Prevention of

Blindness at the annual meeting of the Society held December 15. This represents a marked expansion over the 1949 budget. Plans call for a stepped-up program on two major fronts: (1) preventive education and service and (2) research.

In discussing future plans, Mr. Mason H. Bigelow, president of the Society, said that a survey made for the Society this year shows that at least $1,000,000 a year could be used effectively — half this amount for educational and other preventive services; half for research in the form of grants to established eye clinics and other research institutions.

The National Society for the Prevention of Blindness has announced the appointment of Robert S. Krueger as director of industrial service. Since 1945 Mr. Krueger has been connected with the American Optical Company, working on industrial vision control programs. Prior to that, as head of the safety department for Pratt & Whitney Aircraft Corporation, he established in 1943 a safety program for the company's seven plants, covering a total of more than 30,000 employees. He is a graduate of the University of Illinois, College of Engineering.

CALIFORNIA

The Stanford University School of Medicine will present a postgraduate conference in clinical ophthalmology, March 27-31, 1950. Registration will be open to physicians who limit their practice to the treatment of diseases of the eye or eye, ear, nose and throat. Instructors will be Dr. A. Edward Maumenee, Dr. Dohrmann K. Pischel, Dr. Jerome W. Bettman, Dr. Earle H. McBain and Dr. Arthur J. Jampolsky.

In order to allow free discussion by members of the conference, registration will be limited to 30 physicians. Programs and further information may be obtained from Office of the Dean, Stanford University School of Medicine, 2398 Sacramento Street, San Francisco 15, Calif.

A meeting of the Superior California Eye Club was held on Dec. 15, 1949. The program was "Tear Sac Surgery" by Dr. Rulon Tillotson, and "Plastic Surgery" by Dr. William J. Johnston. Officers for the year 1950 are Dr. Theodore Holstein, president, and Dr. John Berg, secretary.

GEORGIA

The Georgia Society of Ophthalmology and Otolaryngology will hold its annual meeting at the General Oglethorpe Hotel in Savannah, March 3-4, 1950. Members and guests are invited to make their reservations directly with the hotel. Registration fee for the lectures is $20.00.

The distinguished lecturers and their subjects will be Dr. Bayard T. Horton, Rochester, Minn., "Treatment of the Dizzy Patient" and "Headaches—Common Varieties and Their Treatment"; Dr. John M. Converse, New York, "Treatment of Acute Maxillofacial Trauma" and "Rhinoplasty"; Dr. Mercer G. Lynch, New Orleans, "Carcinoma of the Larynx and Methods of Approach Including Lynch Suspension" and "Radical External Sinus Operations"; Dr. Meyer Wiener, Coronado, Calif., "Medical Ophthalmology" and "Surgical Ophthalmology"; Dr. Milton L. Berliner, New York, "Slit Lamp Microscopy"; Dr. Wendell L. Hughes, Hempstead, N. Y., "Lid Reconstruction" and "Personal Procedures in Ophthalmology."

The Clay Memorial Eye Clinic and the Emory University School of Medicine through the William L. Crawley Fund have established an Eye Bank at the Grady Memorial Hospital, 36 Butler Street, S.E., Atlanta 3, Ga. The facilities of the Eye Bank are available, without charge, to ophthalmologists and co-operating hospitals throughout the Southeast and any other region of the country. Local transportation for the Atlanta area is provided by the Atlanta Chapter of the American Red Cross Motor Corps and regional transportation is provided through the Capital, Delta, Eastern, and Southern airlines. These airlines have offered their facilities without cost. Any information regarding the function of the Eye Bank may be obtained from the Eye Bank, Clay Memorial Eye Clinic, 72 Armstrong Street, S.E., Atlanta 3, Ga.

The faculty of Emory University School of Medicine has announced the promotion of Dr. F. Phinizy Calhoun, Jr., to professor and chairman of the department of ophthalmology, and of Dr. Alton V. Hallum to professor of clinical ophthalmology.

ILLINOIS

The regular meeting of the Chicago Ophthalmological Society was held on Dec. 19, 1949. At the afternoon session

Dr. James E. Lebensohn spoke on "The Seeing Factor in Traffic Safety." The scientific program which followed a short business meeting in the evening included "Post-Traumatic Anterior Chamber Cysts Treated Successfully by Electrocoagulation," by Dr. Edward J. Zeiss; and "Surgical Treatment of Non-paralytic Esotropia — Evaluation of Operative Results from a Neurologic Viewpoint," by Dr. George G. Guibor.

Dr. John Hughes Dunnington, professor of ophthalmology, Columbia University, New York, delivered the Sixth Annual Sanford R. Gifford Memorial Lecture on Monday, Jan. 16, 1950, at a meeting of the Chicago Ophthalmological Society. His subject was "Healing of Cataract Incisions."

The monthly meeting of the Chicago Laryngological and Otological Society was held on January 9. The scientific program included: "Inner Ear Deafness of Sudden Onset," Dr. Jacob J. Zuidema (by invitation) and Dr. John R. Lindsay, department of otolaryngology, University of Chicago; "Deafness Following Head Trauma: A Clinical and Experimental Study," Dr. Harold F. Schuknecht (by invitation), department of otolaryngology, University of Chicago; "Some Unusual Mixed Cell Tumors of the Nose and Throat," Dr. Henry B. Perlman, department of otolaryngology, University of Chicago.

At the regular meeting of the Society held on February 6, the scientific program included "Tumors of the Trachea," Drs. Paul Holinger, Frank Novak, III (by invitation) and Kenneth Johnston (by invitation), department of otolaryngology, University of Illinois; "Rhinoscleroma: Case Report," Drs. Samuel M. Morwitz and Irwin D. Horwitz (by invitation), department of otolaryngology, University of Illinois; and "Protruding Ears: Correction by Plastic Surgery (film)", Dr. Oscar Becker (by invitation), department of otolaryngology, University of Illinois.

IOWA

The Sioux Valley Eye and Ear Academy was held in Sioux City on Jan. 26, 1950, in conjunction with the Sioux Valley Medical Society. The officers of this society are: Dr. James Reeder, Jr., president, and Dr. W. P. Davey, secretary-treasurer.

LOUISIANA

A continuation course in ophthalmology will be held in New Orleans, March 13-18, 1950, given by the department of ophthalmology and the division of graduate medicine of Tulane University. Guest lecturers will be: Dr. Daniel B. Kirby, professor emeritus of ophthalmology, New York University Medical School, New York; Dr. Frank B. Walsh, associate professor of ophthalmology, Wilmer Ophthalmological Institute of the Johns Hopkins Hospital and University, Baltimore; Dr. Robert J. Masters, professor of ophthalmology, University of Indiana Medical School, Indianapolis; Dr. Harold Falls, associate professor of ophthalmology, University of Michigan Medical School, Ann Arbor; and Dr. Charles Sheard, distinguished lecturer in ophthalmology, Tulane University of Louisiana, professor emeritus of experimental biophysics, Graduate School, University of Minnesota (Mayo Foundation). Additional lectures will be given by resident faculty members of the department of ophthalmology, Tulane University.

This year the Louisiana-Mississippi Ophthalmological and Otolaryngological Society will hold its meeting at the St. Charles Hotel in New Orleans, La. on Saturday, April 22, 1950. The following program has been arranged: "President's Address," Dr. William A. Wagner, New Orleans; "The Use of Beta Radiation in Industrial Ophthalmology," Dr. A. D. Ruedemann, Detroit; "The Differential Diagnosis of Hearing Disorders," Dr. Paul A. Campbell, Chicago; "Some Practical Points Regarding Retinal Detachment Surgery," Dr. James S. Shipman, Philadelphia; and "The Diagnosis and Management of Respiratory Tract Obstruction—(including Laryngotracheobronchitis)," Dr. Paul H. Holinger, Chicago. The profession is cordially invited to attend.

MICHIGAN

The department of postgraduate medicine of the University of Michigan Medical School announces the annual conference in ophthalmology for qualified physicians, April 24-26, 1950, to be given at the Horace H. Rackham Graduate School Building, Ann Arbor, under the direction of the department of ophthalmology at the University of Michigan. Guest lecturers: Dr. John B. Hitz, Milwaukee; Dr. Herman Elwyn, New York; Dr. Albert E.

Sloane, Boston; Dr. Paul L. Cusick, Detroit; and Dr. Kenneth C. Swan, Portland, Ore. Resident lecturers: Dr. F. Bruce Fralick, Dr. Harold F. Falls, and Dr. John W. Henderson.

Complete program and details will be mailed upon request addressed to Dr. Howard H. Cummings, Chairman, Department of Postgraduate Medicine, University Hospital, Ann Arbor, Mich.

MISSOURI

The regular January meeting of the St. Louis Ophthalmic Society was held in Elliot Auditorium of McMillan Hospital on January 27. Dr. Harry Rosenbaum gave a paper on "Aneurysms at the Circle of Willis" with a presentation of two case reports. The discussion was by Dr. Henry Schwartz and Dr. T. E. Sanders presented "Pseudoglioma" (preliminary report).

NEW JERSEY

A meeting of the Eye, Ear, Nose and Throat Section of the Academy of Medicine of Northern New Jersey was held on February 16. Included in the scientific program was a paper by Dr. Isadore Givner, associate clinical professor of ophthalmology, New York University, and attending ophthalmologist at the Beth David Hospital and City Hospital, New York, on "Ophthalmological Expressions of Some Systemic Diseases."

NEW YORK

A meeting of the Eastern New York Eye, Ear, Nose and Throat Association was held on Jan. 5, 1950, at Schenectady. Dr. Joseph A. Gabriels, speaker of the evening, discussed "A Typical Retinoscopy and the Fundus." A sound-color film on "The Function of the Ear in Health and Disease" was shown through the courtesy of the Doho Chemical Company, and short reports on the highlights of the recent Academy meeting in Chicago were given by Dr. John A. Cetner and Dr. Frank C. Furlong.

At the regular meeting of the Eastern New York Eye, Ear, Nose and Throat Association on February 2, Dr. George J. Righter presented a paper on "Abscess of Infratemporal Fossa." An interesting color film depicting his operation of intracapsular cataract extraction was shown by Dr. Joseph L. Holohan.

The New York Polyclinic Medical School and Hospital will conduct a five-day Seminar in Otolaryngology-Ophthalmology, April 17-21. This seminar will consist of a review of recent advances in the diagnosis and treatment of the more common disorders in the fields of otolaryngology and ophthalmology, comprising lectures, motion pictures and demonstrations in the clinics, operating rooms and dissecting room. Members of the staff and visiting speakers will participate. Among the guest speakers will be: Dr. August L. Beck, New Rochelle Hospital, New Rochelle, N. Y.; Dr. Conrad Berens, New York Eye and Ear Infirmary, New York; Dr. Paul A. Chandler, Massachusetts Eye and Ear Infirmary, Boston; Dr. Arthur J. Cracovaner, Lenox Hill Hospital, New York; Dr. French K. Hansel, Hansel Foundation, St. Louis; Dr. Wendell L. Hughes, New York Eye and Ear Infirmary, New York; Dr. Ira I. Kaplan, Bellevue Hospital, New York; Dr. John E. Kernan, Columbia University, College of Physicians and Surgeons, New York; Dr. Alfred Kestenbaum, New York University, New York; Dr. F. L. Philip Koch, New York University, New York; Dr. John R. Lindsay, University of Chicago School of Medicine, Chicago; Dr. Romeo A. Luongo, Graduate School of Medicine, University of Pennsylvania, Philadelphia; Dr. William J. McNally, McGill University, Montreal, Quebec, Canada; Dr. Brittain F. Payne, New York Eye and Ear Infirmary, New York; Dr. Algernon B. Reese, Columbia University, College of Physicians and Surgeons, New York; Dr. Allan Rossby, Lincoln Hospital, New York; Dr. George E. Shambaugh, Jr., Northwestern Medical School, Chicago; Dr. Ludwig von Sallmann, Institute of Ophthalmology, Presbyterian Hospital, New York; Dr. Ernest A. Weymuller, New York Eye and Ear Infirmary, New York; and Dr. L. Holland Whitney, New Jersey Bell Telephone Company, Newark, N. J.

OREGON

The Annual Spring Convention in Ophthalmology and Otolaryngology will be held in Portland, March 19-24, 1950. A fine program has been arranged by the Oregon Academy and the University of Oregon Medical School. This year the meeting has been divided into two sections: (1) Otolaryngology, which will be held on Monday and Tuesday, and on Wednesday morning; and (2) Ophthalmology, which will be held on Wednesday

afternoon, Thursday, and Friday morning. Guest speakers are: Dr. John R. Lindsay, professor of otolaryngology at the University of Chicago Medical School; Dr. Gordon D. Hoople, professor of otolaryngology at the Syracuse University Medical School; Dr. Paul Chandler, professor of ophthalmology at Harvard University Medical School; and Dr. Michael Hogan, associate professor of ophthalmology at the University of California Medical School.

On Thursday evening, March 23, Dr. Chandler will deliver the first John E. Weeks Memorial Lecture in Ophthalmology. Friday afternoon and evening, March 24, the Pacific Coast Section of the Association for Research in Ophthalmology will hold its annual meeting.

PENNSYLVANIA

The ninety-eighth meeting of the Reading Eye, Ear, Nose and Throat Society was held on Nov. 16, 1949. The meeting consisted of a Study Club on "Retrobulbar Neuritis" conducted by Dr. John H. Kupp of Palmerton, Pa., and a paper by Dr. Joseph P. Atkins of Philadelphia, the title of which was "Practical Considerations in Hoarseness."

The Section of Ophthalmology of the College of Physicians of Philadelphia met on Dec. 15, 1949. A case of "Thyrotropic Exophthalmos and Pseudotumor" was presented by Dr. Edmund B. Spaeth and Dr. Howard Bedrossian. Dr. William O. LaMotte, Jr., and Dr. George S. Tynor (by invitation) discussed "Observations on Retrolental Fibroplasia"; and Dr. Robert Peckham (by invitation) spoke on "Reduction in Visual Acuity Due to Sunlight."

The Committee on Graduate Education, Allegheny County Medical Society, has announced that a course in the practical application of the slit lamp microscope and new methods in gonioscopy will be given by the department of ophthalmology of the Montefiore Hospital, Pittsburgh, under the direction of Dr. Harvey E. Thorpe and associates. Courses on intraocular surgery will be included.

Instruction will begin on Monday, February 27, and will continue for 6 days through March 4. Further information may be obtained from the Committee on Graduate Education, Allegheny County Medical Society, 225 Jenkins Building, Pittsburgh 22, Pa.

TEXAS

The Nineteenth Annual Spring Clinical Conference of the Southern Clinical Society will be held March 13-16, 1950, at Hotel Adolphus and The Baker Hotel, Dallas. The registration fee of $20.00 will admit one to all features of the conference, including lectures, luncheons, evening meetings and the annual banquet on Thursday evening—an all-inclusive fee.

Guest speaker for the Section in Ophthalmology will be Dr. John M. McLean, New York, who will discuss "Ophthalmological Approach to Progressive Postoperative Exophthalmos," "The Use of Anticoagulants in Ophthalmology," "The Present Status of Corneal Transplantation," and "Modern Surgery of Oblique Muscles."

Dr. Robert E. Votaw, St. Louis, will be guest speaker for the Section on Otolaryngology. Subjects which he will discuss are "Sinusitis and Chronic Pulmonary Disease," "Headache from the Otolaryngologist Viewpoint," "Sinusitis in Children," and "Recent Advances in Surgical Treatment of Malignancies of Pharynx and Larynx."

At a clinic meeting on Wednesday afternoon, March 15, a discussion of recent therapeutic advances in ophthalmology and otolaryngology will be led by Dr. Andres Goth, "Antibiotics"; Dr. Arthur Grollman, "Antihistamines"; Dr. Lester H. Quinn, "New Myotics in Glaucoma"; Dr. J. Dudley Singleton, "Management of Acute Rhino-Sinusitis"; Dr. Maxwell Thomas, "Cataract Extraction for the Occasional Operator"; and Dr. Lyle M. Sellers, "Diagnosis of Vertigo."

VIRGINIA

The Gill Memorial Eye, Ear, and Throat Hospital will present the Twenty-Third Annual Spring Congress in Ophthalmology and Otolaryngology, April 3-8, 1950, at Roanoke, Va.

Only physicians who are limiting their practice exclusively to ophthalmology, otology, rhinology, laryngology, faciomaxillary surgery, bronchoscopy and esophagoscopy, and who are members of their local medical societies are eligible to attend.

The recent advances and accepted methods of treatment in these specialties will be presented by means of clinical lectures, lantern slides, motion pictures, and surgical demonstrations.

Guests of honor, who will head a distinguished faculty, will be Dr. C. W. Mayo, Rochester, Minn.; Sir Alexander Fleming, London, England; Dr. Conrad Berens, New York; Dr. Arthur J. Bedell, Albany, N. Y.; Dr. Edmund Spaeth, Philadelphia; and Dr. Gabriel Tucker, Philadelphia.

Further information may be obtained by writing Dr. E. G. Gill, Box 2467, Roanoke, Va.

WISCONSIN

The regular meeting of the Milwaukee Oto-Ophthalmic Society was held on January 24. Dr. H. Isabelle McGarry of the Illinois Eye and Ear Infirmary discussed "Management of the Glaucoma Clinic."

AUSTRALIA

The tenth annual general meeting of the Ophthalmological Society of Australia will be held at Brisbane, Queensland, in the last week of May 1950, in conjunction with the British Medical Association Congress, Seventh Session.

CANADA

The Montreal Ophthalmological Society held its second meeting of the current season in the Eye Clinic of the Notre Dame Hospital on Dec. 15, 1949. The following cases were reported: "Occipital Tumor—Hemianopsia, with Conservation of Central Vision" and "Tumor of Pineal Gland," Dr. C. Bertrand (by invitation); "Infantile Glaucoma" and "Lattice-like Keratitis," Dr. J. Brault; "Vertical Diplopia with Possible Tumor of the Brain," Dr. H. Magder; "Recurring Hemorrhage (Evolution)," Dr. L. Gelinas; "End Result of Traumatic Injury to Fundus of the Eye," Dr. M. Kaufmann; "Old Traumatic Cataract," Dr. E. Blain; "Hole in the Macula," Dr. J. Brahy; "Familial Retrobulbar Neuritis," Dr. A. Godin; "Anterior Sclerotic Staphyloma" and "Oculoglandular Syndrome of Parinaud," Dr. R. Charbonneau; "Melanoma of the Choroid" and "Hemorrhagic Glaucoma (Post-Traumatic)," Dr. R. Cloutier.

EGYPT

The Annual Meeting of the Ophthalmological Society of Egypt will take place at the Memorial Ophthalmic Laboratory, Giza, Egypt, on Wednesday and Thursday, March 15 and 16, 1950, at 9 a.m. The symposium will be on sympathetic ophthalmia. Medical practitioners, oculists or otherwise, are cordially invited.

ALUMNI DINNERS

Alumni Dinners will be held on October 9, 1950, at 6:30 p.m. All groups wishing to make arrangements for Alumni Dinners may do so through Mr. Richard L. Collison, Sales Manager, Palmer House, Chicago, Ill.

Upon request, the Academy will print tickets and arrange for their sale at the Registration Desk at the meeting. If the required information, which includes name of group, place of dinner (hotel and room), and name and address of group secretary, is received by July 1, announcement of the dinner will be published in the July-August issue of the TRANSACTIONS. The Academy will assume no financial responsibility for expenses incurred by any alumni group.

DIRECTORY OF OPHTHALMOLOGIC AND OTOLARYNGOLOGIC SOCIETIES

INTERNATIONAL

International Association for Prevention of Blindness

President: Dr. P. Bailliart
Secretary-General: Dr. A. Churchill, 66 Boulevard Saint-Michel, Paris, 6e, France

International Council of Ophthalmology

President: Prof. F. W. Nordenson
Secretary: Dr. Halger Ehlers, Rigshospital, Copenhagen, Denmark

International Organization Against Trachoma

President: Dr. A. F. MacCallan
Secretary: Dr. F. Wibaut, P. C. Hoofstraat 145, Amsterdam, Holland

Pan-American Association of Ophthalmology

President: Dr. Conrad Berens
Secretary: Dr. Thomas D. Allen, 122 South Michigan Avenue, Chicago 2, Ill.
Time and Place: Interim Meeting: March 26-31, 1950. Miami Beach, Fla.
IV Pan-American Congress of Ophthalmology early in 1952

Pan-American Association of Ophthalmology, Puerto Rico Chapter

President: Dr. Luis J. Fernandez, Box 2206, San Juan 10, Puerto Rico
Secretary: Dr. P. Fernandez
Place: San Juan

FOREIGN

All-India Ophthalmological Society

President: Dr. S. A. Rahim
Secretaries: Dr. G. Zachariah, 16 Marshall's Road, Egmore, Madras
Dr. S. N. Cooper, Laud Mansion, 15 Queen's Road, Bombay

Belgian Ophthalmologic Society

President: Dr. L. Weekers
Secretary-General: Dr. M. Appelmans, Avenue Ruelens 179, Louvain
Time and Place: January, June and November. Bruxelles

Bombay Ophthalmologists' Association

President: Rotated
Conveners: Dr. S. N. Cooper and Dr. B. D. Telang, Laud Mansion 21, Queen's Road, Bombay 4

British Medical Association, Section on Ophthalmology

President: Mr. O. G. Morgan
Secretary: Mr. A. G. Cross, 27 Harley Street, London W. 1, England

Chengtu Ophthalmological Society

President: Dr. Eugene Chan
Secretary: Dr. D. S. Shen, Eye, Ear, Nose and Throat Hospital, Chengtu, Szechuan, China
Place: Eye, Ear, Nose and Throat Hospital, Chengtu, Szechuan, China

Chinese Ophthalmology Society

President: Dr. C. H. Chou
Secretary: Dr. F. S. Tsang, 221 Foochow Road, Shanghai

Chinese Ophthalmological Society of Peiping

President: Dr. H. T. Pi
Secretary: Dr. C. K. Lin, 180 Hsi-Lo-yen Chienmeng, Peiping
Time and Place: Last Friday of each month. Peiping Union Medical College

Deutsche Ophthalmologische Gesellschaft Heidelberg

President: Prof. Dr. med. K. Wessely
Secretary: Prof. Dr. med. E. Engelking, Heidelberg, Universitäts-Augenklinik
Place: Heidelberg

Faculty of Ophthalmologists

President: Dr. Frank W. Law, 45 Lincoln's Inn Fields, London, W.C. 2, England
Secretary: Dr. J. H. Doggart, F.R.C.S.

German Ophthalmological Society

President: Prof. W. Lohlein
Secretary: Prof. E. Engelking, Heidelberg

Hungarian Medical Trade Union, Section of Ophthalmology

President: I. Csapody
Secretary: E. Galla, Krisztina Körut 139, Budapest, Hungary
Place: Illes u. 15, Budapest

Hungarian Ophthalmological Society

President: Prof. G. Horay
Assistant Secretary: Dr. Stephen de Grosz, University Eye Hospital, No. 1, Illesucca 15, Budapest

Israel Ophthalmological Society

President: Dr. Arych Feigenbaum
Secretary: Dr. E. Sinai, 9 Bialik Street, Tel Aviv

Secretaries of societies are requested to furnish the information necessary to make this list complete and keep it up to date.

MIDLAND OPHTHALMOLOGICAL SOCIETY

President: Dr. H. Campbell Orr
Secretary: Dr. P. Jameson Evans, 51 Calthorpe Road, Birmingham 3, England
Place: Birmingham and Midland Eye Hospital

NEDERLANDSCH OOGHEELKUNDIG GEZELSCHAP

President: Prof. A. W. Mulock Houwer
Secretary: Dr. T. A. Vos, Laan v. Meerdervoort 394, the Hague

NORTH OF ENGLAND OPHTHALMOLOGICAL SOCIETY

President: Mr. J. S. Arkle
Secretary: Mr. W. M. Muirhead, 70 Upper Hanover Street, Sheffield 3, England
Time and Place: October to May. Manchester, Leeds, Newcastle, Liverpool, Sheffield and Bradford

OPHTHALMOLOGICAL AND OTO-LARYNGOLOGICAL SOCIETY OF ALBERTA

President: Dr. R. F. Nicholls
Secretary: Dr. Mark R. Levey, Wells Pavillion, University Hospital, Edmonton, Alberta

OPHTHALMOLOGICAL SOCIETY OF AUSTRALIA

President: Dr. W. Lockhart Gibson
Secretary: Dr. Arnold L. Lance, 135 Macquarie Street, Sydney, New South Wales
Time and Place: May, 1950. Brisbane, Queensland

OPHTHALMOLOGICAL SOCIETY OF EGYPT

President: Dr. F. Maxwell Lyons
Secretary: Dr. Mahmound Lutfi, Ophthalmic Hospital, Giza
Place: Dar El Hekmah, 42, Kasr El Ainy, Cairo

OPHTHALMOLOGICAL SOCIETY OF HOSPITAL DE NUESTRA SENORA DE LA LUZ

Chairman: Dr. Manuel J. Icaza y Dublan
Secretary: Dr. Jorge Meyran, Ezequiel Montes 135, México, D. F.
Time and Place: Second Friday of each month. Hospital de Neustra Senora de la Luz

OPHTHALMOLOGICAL SOCIETY OF NEW ZEALAND

President: Mr. W. A. Fairclough
Secretary: Dr. W. J. Hope-Robertson, Kelvin Chambers, 16 The Terrace, Wellington

OPHTHALMOLOGICAL SOCIETY OF SOUTH AFRICA

President: Dr. M. Fine
Secretary: Dr. R. L. H. Townsend, National Mutual Building, Church Square, Cape Town

OPHTHALMOLOGICAL SOCIETY OF THE UNITED KINGDOM

President: F. A. Juler, C.V.O., F.R.C.S.
Secretaries: Geoffrey J. O. Bridgeman, M.C., F.R.C.S.; Dr. A. C. Cross, F.R.C.S.

OXFORD OPHTHALMOLOGICAL CONGRESS

Master: Mr. F. A. Williamson-Noble
Secretary-Treasurer: Dr. Ian C. Fraser, 12 St. John's Hill, Shrewsbury, England
Time and Place: July. Oxford, England

PHILIPPINE OPHTHALMOLOGICAL AND OTOLARYNGOLOGICAL SOCIETY

President: Dr. Edmundo Reyes
Secretary-Treasurer: Dr. Carlos V. Yambao, Philippine General Hospital, Manila

POLISH OPHTHALMOLOGICAL SOCIETY

President: Prof. Dr. W. Kapuscinski
Secretary: Dr. S. Topolski, Piusa 38, Warsaw, Poland
Time and Place: Every two years—summer. Ophthalmic Clinic, Oczki 6, Warsaw

PUERTO RICO MEDICAL ASSOCIATION, SECTION OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. A. Navas Torres
Secretary: Dr. A. Laugier, San Juan
Time and Place: Monthly. Asociacion Medica de Puerto Rico, Santurce

ROYAL SOCIETY OF MEDICINE, SECTION OF OPHTHALMOLOGY

President: Dr. Montague L. Hine, F.R.C.S.
Secretaries: Dr. Arthur Lister, Dr. H. E. Hobbs, 1 Wimpole Street, London, W.1, England

SAO PAULO SOCIETY OF OPHTHALMOLOGY

President: Dr. Durval Prado
Secretary: Dr. Rubens Belfort Mattos, Rua B. Stapetininga, 29 F-3° andar, Sao Paulo, Brazil

SCOTTISH OPHTHALMOLOGICAL CLUB

President: Dr. Alexander Garrow
Secretary: Dr. John Marshall, 11 Claremont Gardens, Glasgow, C.3, Scotland
Time and Place: March and October. Edinburgh and Glasgow, in rotation

SOCIEDAD ARGENTINA DE OFTALMOLOGIA

President: Dr. Diego M. Arguello
Secretary: Dr. Pedro F. Garcia Nocito, Vicente Lopez 1756 A, Buenos Aires, Argentina
Time and Place: Third Wednesday of every month. Buenos Aires

SOCIEDADE BRASILEIRA DE OFTALMOLOGIA

President: Dr. Natalicio de Farias
Secretary: Dr. Ismar Pereira, Praca Floriano 55, 5° andar, Rio de Janeiro, Brazil
Time: Third Friday of every month from April to December

SOCIEDAD COLOMBIANA DE OFTALMOLOGIA Y DE OTORRINOLARINGOLOGIA

President: Dr. Jorge Suarez-Hoyos, Carrera 5a, no. 13-39, Bogota, Colombia
Secretary: Dr. Francisco Arango
Time and Place: Second Tuesday of each month. Club Medico

SOCIEDAD CHILENA DE OFTALMOLOGIA
President: Dr. Italo Martini Zerega
Secretary: Dr. Adrian Araya Costa, Renaca, no. 34, Santiago, Chile
Place: Santiago

SOCIEDAD CUBANA DE OFTALMOLOGIA
President: Prof. Lorenzo Comas
Secretary: Dr. Oscar F. Horstmann, Calle 5ta. no. 702, Vedado, Habana, Cuba
Time: Second Tuesday of each month

SOCIEDAD MEXICANA DE OFTALMOLOGIA
President: Dr. Feliciano Palomino Dena
Secretary: Dr. Teodulo Agundis, Jr., Lucerna 63, México, D. F.
Time and Place: 8:30 p.m., first Tuesday of each month. Escuela Nacional de Medicina, Venezuela 4, México, D. F.

SOCIEDAD DE OFTALMOLOGIA DE CORDOBA
Chairman: Dr. Roberto Obregon Oliva
Secretary: Dr. Alberto Urrets Zavalia (hijo), 27 de Abril 255, Cordoba, Argentina

SOCIEDAD DE OFTALMOLOGIA DE GUADALAJARA
President: Dr. Enrique Avalos Gonzales
Secretary: Dr. Jesus Gomez Plasencia, Pedro Moreno 587, Guadalajara, Mexico
Time and Place: Second Thursday of each month. Edifico Lutecia, Desp. 101

SOCIEDAD DE OFTALMOLOGIA DEL LITORAL
President: Dr. Juan Manuel Vila Ortiz, Cordoba 1915, Rosario, Argentina
Secretary: Dr. Carlos M. Soto
Time and Place: Last Sunday in every month. Rosario

SOCIEDADE DE OFTALMOLOGIA DEL NORTE
President: Dr. Jorge Luis Castillo
Secretary: Dr. Felix Berman, San Lorenzo 345, Tucuman, Argentina
Place: Mendoza 421, Tucuman

SOCIEDADE DE OFTALMOLOGIA DE MINAS GERAIS
President: Prof. Hilton Rocha
Secretary: Dr. Oswaldo Carvalho
Place: Belo Horizonte, Minas Gerais, Brazil

SOCIEDADE DE OFTALMOLOGIA E OTORINOLARINGOLOGIA DE RIO GRANDE DO SUL
President: Dr. Luiz Assumpcao Osorio
Secretary: Dr. Fernando Voges Alves, Caixa Postal 928, Porto Alegre, Rio Grande do Sul

SOCIEDADE DE OFTALMOLOGIA E OTO-RHINO-LARYNGOLOGIA DE BAHIA
President: Dr. Theonilo Amorim, Barra Avenida, Bahia, Brazil
Secretary: Dr. Adroaldo de Alencar

SOCIETA OFTALMOLOGICA ITALIANA
President: Prof. Giuseppe Ovio
Secretary: Prof. E. Leonardi, Piazza degli Eroi, 11 Roma, Italy
Place: Roma Piazza degli Eroi 11

SOCIETE FRANCAISE D' OPHTALMOLOGIE
Secretary: Dr. Edward Hartmann, Hospital Laribosiere, Paris 10, France

SOCIETY OF SWEDISH OPHTHALMOLOGISTS
President: Prof. S. Larsson
Secretary: Dr. K. O. Granstrom, Sodermalmstorg 4, Stockholm, Sweden

SOUTHERN OPHTHALMOLOGICAL SOCIETY, ENGLAND
President: Dr. C. C. Schurr
Secretary: Mr. Nigel Cridland, 25 Craneswater Pk., Southsea, England
Time: March to October

NATIONAL

AMERICAN ASSOCIATION OF EYE, EAR, NOSE AND THROAT SOCIETY SECRETARIES
President: Dr. Kenneth L. Craft
Secretary-Treasurer: Dr. Daniel S. DeStio, Highland Building, Pittsburgh 6, Pa.

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. J. Mackenzie Brown
Executive Secretary-Treasurer: Dr. William L. Benedict, 100 First Avenue Building, Rochester, Minn.
Time and Place: October 8-13, Chicago

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCITY, INC.
President: Dr. Robert C. Martin
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Building, Rochester 7, N. Y.
EASTERN SECTION
Vice-President: Dr. Robert L. Moorhead
Secretary: Dr. Francis W. Davison, Geisinger Memorial Hospital, Danville, Pa.

MIDDLE SECTION
Vice-President: Dr. J. Marion Sutherland
Secretary: Dr. Walter H. Theobald, 307 North Michigan Avenue, Chicago 1, Ill.

SOUTHERN SECTION:
Vice-President: Dr. William D. Stinson
Secretary: Dr. Lewie M. Griffith, 301 Haywood Building, Asheville, N. C.

WESTERN SECTION:
Vice-President: Dr. Jesse B. Naftzger
Secretary: Dr. Russell M. Decker, 65 North Madison Avenue, Pasadena, Calif.

AMERICAN MEDICAL ASSOCIATION, SCIENTIFIC ASSEMBLY, SECTION ON OPHTHALMOLOGY
Chairman: Dr. A. Ray Irvine
Secretary: Dr. Trygve Gundersen, 101 Bay State Road, Boston, Mass.
Time and Place: June 26-30. San Francisco

AMERICAN OPHTHALMOLOGICAL SOCIETY
President Dr. Bernard Samuels
Secretary-Treasurer: Dr. Maynard C. Wheeler, 30 West 59th Street, New York 19, N. Y.

ASSOCIATION FOR RESEARCH IN OPHTHALMOLOGY, INC.
Chairman: Dr. Walter H. Fink
Secretary-Treasurer: Dr. James H. Allen, 1430 Tulane Avenue, New Orleans, La.
Time and Place: June 24-25. San Francisco

CANADIAN MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY
President: Dr. R. G. C. Kelly
Secretary: Dr. J. Clement McCulloch, 380 Medical Arts Building, Toronto, Ontario

CANADIAN OPHTHALMOLOGICAL SOCIETY
President: Dr. R. F. Nicholls
Secretary: Dr. J. F. A. Johnston, 174 St. George Street, Toronto, Ontario
Time and Place: June 23-24. "The Pines", Digby, Nova Scotia

NATIONAL SOCIETY FOR THE PREVENTION OF BLINDNESS, INC.
President: Mr. Mason H. Bigelow
Secretary: Dr. Franklin M. Foote, 1790 Broadway, New York 19, N. Y.

REGIONAL

ARK-LA-TEX OTO-OPHTHALMIC SOCIETY
President: Dr. W. Griffin Jones
Secretary: Dr. Frank L. Bryant, 2622 Greenwood, Shreveport, La.
Time and Place: First Monday of month, October through May. Shreveport Club

HAWAII EYE, EAR, NOSE AND THROAT SOCIETY
Chairman: Dr. Robert T. Wong
Secretary: Dr. Ogden D. Pinkerton, Suite 7, Young Building, Honolulu 13, T. H.
Time and Place: Third Thursday of each month (dinner meetings). Pacific Club, Honolulu

INTER-MOUNTAIN OTO-OPHTHALMOLOGICAL SOCIETY
President: Dr. R. O. Porter
Secretary: Dr. Harry O. Frazier, 707 Medical Arts Building, Salt Lake City 1, Utah
Time and Place: Third Monday of each month, September through May. University Club, 136 East South Temple, Salt Lake City

LOUISIANA-MISSISSIPPI OPHTHALMOLOGICAL AND OTOLARYNGOLOGICAL SOCIETY
President: Dr. William A. Wagner
Secretary: Dr. Edley H. Jones, 1301 Washington Street, Vicksburg, Miss.
Time and Place: April 22, 1950. St. Charles Hotel, New Orleans

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY
President: Dr. Benjamin A. Sachs
Secretary: Dr. Garrett L. Sullivan, 101 Bay State Road, Boston 15, Mass.
Time and Place: Third Wednesday of each month, November through April. Massachusetts Eye and Ear Infirmary

NEW ENGLAND OTO-LARYNGOLOGICAL SOCIETY
President: Dr. Lyman G. Richards
Secretary-Treasurer: Dr. Burton E. Lovesey, 76 Bay State Road, Boston 15, Mass.
Time and Place: Quarterly. Massachusetts Eye and Ear Infirmary, 243 Charles Street, Boston

PACIFIC COAST OTO-OPHTHALMOLOGICAL SOCIETY
President: Dr. David R. Higbee
Secretary-Treasurer: Dr. C. Allen Dickey, 450 Sutter Street, San Francisco, Calif.
Time and Place: May 28-31, 1950. St. Francis Hotel, San Francisco

SAGINAW VALLEY ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. V. E. Cortopassi
Secretary: Dr. A. J. Cortopassi, 324 South Washington Avenue, Saginaw, Mich.
Time and Place: Second Tuesday evening of each month, except summer months. Bancroft Hotel, Saginaw

SIOUX VALLEY EYE AND EAR ACADEMY
President: Dr. James Reeder, Jr.
Secretary-Treasurer: Dr. W. P. Davey, 627-632 Frances Building, Sioux City, Iowa

SOUTHERN MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY
Chairman: Dr. Alston Callahan
Secretary: Dr. Edley H. Jones, 1301 Washington Street, Vicksburg, Miss.
Time and Place: November 13-16. St. Louis, Mo.

STATE

ARKANSAS STATE MEDICAL SOCIETY, EYE, EAR, NOSE AND THROAT SECTION
President: Dr. C. G. Hinkle
Secretary: Dr. K. W. Cosgrove, 113 East Capitol Avenue, Little Rock, Ark.
Time and Place: Annual meeting, April 18, 1950. Fort Smith

COLORADO OPHTHALMOLOGICAL SOCIETY
President: Dr. J. Leonard Swigert
Secretary: Dr. James C. Strong, 227 Sixteenth Street, Denver, Colorado
Time and Place: Every third Saturday. Colorado Medical Center

FLORIDA SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. W. Jerome Knauer
Secretary-Treasurer: Dr. Charles C. Grace, 145 King Street, St. Augustine, Fla.
Time and Place: April 23, 1950. Hollywood

GEORGIA SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. Lester A. Brown
Secretary: Dr. Braswell E. Collins, 701 Elizabeth Street, Waycross, Ga.
Time and Place: First Friday and Saturday of March. General Oglethorpe Hotel, Savannah

INDIANA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. E. W. Dyar
Secretary-Treasurer: Dr. M. S. Harding, 308 Hume Mansur Building, Indianapolis, Ind.
Time and Place: May 3-4. Lafayette

IOWA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. Byron Merkel
Secretary: Dr. Carl A. Noe, 601-611 Highley Building, Cedar Rapids
Time and Place: 1950, Des Moines

KANSAS STATE MEDICAL SOCIETY, SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. N. L. Francis
Secretary: Dr. W. D. Pitman, First National Bank Building, Pratt, Kan.
Time and Place: May 16-17, 1950. Wichita

MICHIGAN TRIOLOGICAL SOCIETY
President: Dr. William D. Irwin
Secretary: Dr. V. E. Cortopassi, 324 South Washington Avenue, Saginaw, Mich.
Time: Second Thursday of November, December, March, April and May

MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. Malcolm C. Pfunder
Secretary: Dr. Frank Adair, 822 Lowry Medical Arts Building, St. Paul 2, Minn.
Time and Place: Second Friday of each month, November through May. Alternating, Minnesota Club, St. Paul, and Minneapolis Club, Minneapolis

MONTANA ACADEMY OF OTO-OPHTHALMOLOGY
President: Dr. Jim Herring
Secretary-Treasurer: Dr. F. D. Hurd, Medical Arts Building, Great Falls, Mont.
Time and Place: Semi-annually. Summer, Bozeman; mid-winter, Diamond S Ranchotel, Boulder

PENNSYLVANIA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. Daniel S. DeStio
Secretary: Dr. Benjamin F. Souders, 143 North Sixth Street, Reading, Pa.
Time and Place: May 12-14. Bedford Springs Hotel, Bedford

SOUTH CAROLINA SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. William M. Carpenter
Secretary-Treasurer: Dr. Roderick Macdonald, Rock Hill, S. C.
Time and Place: September 11-13. Hendersonville, N. C. (jointly with North Carolina Eye, Ear, Nose and Throat Society)

TENNESSEE STATE ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. Sam H. Sanders
Secretary-Treasurer: Dr. Roland H. Myers, 1720 Exchange Building, Memphis, Tenn.
Time: Annually, April 10.

TEXAS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. V. R. Hurst
Secretary: Dr. John L. Matthews, 414 Navarro Street, San Antonio 5, Texas
Time and Place: December 1950, Dallas

VIRGINIA SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. Francis H. McGovern
Secretary-Treasurer: Dr. Peter N. Pastore, Box 25, Medical College of Virginia Station, Richmond 19, Va.

WEST VIRGINIA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. Garnett P. Morison
Secretary: Dr. Melvin W. McGehee, 425 Eleventh Street, Huntington 1, W. Va.
Time and Place: (Biannual) Next meeting, May 7, 8 and 9, 1950. The Greenbrier, White Sulphur Springs

LOCAL

ACADEMY OF MEDICINE OF NORTHERN NEW JERSEY, SECTION ON EYE, EAR, NOSE AND THROAT
Chairman: Dr. Anthony M. Sellitto
Secretary: Dr. Francis J. Grant, 1224 Salem Avenue, Hillside, N. J.
Time and Place: Second Monday of the month. The Academy of Medicine, 91 Lincoln Park, South, Newark

AKRON ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. C. R. Anderson
Secretary-Treasurer: Dr. A. L. Peter, 406 Akron Savings and Loan Building, Akron, Ohio
Time and Place: 6:30 p.m., first Monday in January, March, May and November. Akron City Club

ATLANTA EYE, EAR, NOSE AND THROAT SOCIETY
President: Dr. Lester A. Brown
Secretary-Treasurer: Dr. James T. King, 384 Peachtree Street N.E., Atlanta 3, Ga.
Time and Place: 7:30 p.m., fourth Monday of each month, October to May. Academy of Medicine

BIRMINGHAM EYE, EAR, NOSE AND THROAT SOCIETY
President: Each member, in alphabetical order.
Secretary: Dr. David A. McCoy, Woodward Building, Birmingham, Ala.
Time and Place: 6:30 p.m., second Tuesday of each month, September through May. Thomas Jefferson Hotel

BOSTON CITY HOSPITAL AURAL AND OPHTHALMIC ASSOCIATION
President: Dr. Joseph Nerbonne
Secretary: Dr. Benjamin Riseman, 41 Bay State Road, Boston 15, Mass.
Time and Place: March 1950. Boston City Hospital

THE BROOKLYN OPHTHALMOLOGICAL SOCIETY
President: Dr. Mortimer A. Lasky
Secretary-Treasurer: Dr. Louis Freimark, 256 Rochester Avenue, Brooklyn 13, N. Y.
Time and Place: 8 p.m., third Thursday in October, December, February and April. Medical Society of the County of Kings, 1313 Bedford Avenue

BUFFALO OPHTHALMOLOGIC CLUB
President: Dr. Arthur L. Bennett
Secretary: Dr. Herbert R. Reitz, 446 Linwood Avenue, Buffalo, N. Y.
Time and Place: Second Thursday of each month, October through May. Park Lane

CENTRAL ILLINOIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. Harold R. Watkins
Secretary-Treasurer: Dr. Philip R. McGrath, 843 Jefferson Building, Peoria, Ill.
Time and Place: April 21-23, Illinois Hotel, Bloomington; September 22-24, Abraham Lincoln Hotel, Springfield

CENTRAL NEW YORK EYE, EAR, NOSE AND THROAT SOCIETY
President: Dr. Cecil B. Hert
Secretary-Treasurer: Dr. James L. McGraw, 619 University Building, Syracuse, N. Y.
Time and Place: April 26. Syracuse

CHATTANOOGA EYE, EAR, NOSE AND THROAT SOCIETY
Chairman and Secretary: Dr. Willard H. Steele, Jr., 552 McCallie Avenue, Chattanooga, Tenn.
Time and Place: 6:30 p.m., fourth Thursday in each month, October through May. Mountain City Club

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY
President: Dr. Oliver E. Van Alyea
Secretary: Dr. Lawrence J. Lawson, 636 Church Street, Evanston, Ill.

THE CHICAGO OPHTHALMOLOGICAL SOCIETY
President: Dr. Derrick Vail
Secretary-Treasurer: Dr. J. Robert Fitzgerald, 3215 W. North Avenue, Chicago
Time and Place: 7:30 p.m., third Monday of each month, October to May. Chicago-Illini Union, 715 S. Wood Street

CINCINNATI OPHTHALMOLOGIC CLUB
Presidium: Dr. Donald J. Lyle, Dr. Karl W. Ascher, Dr. Josef D. Weintraub
Secretary: Dr. Josef D. Weintraub, 715 Provident Bank Building, Seventh and Vine Streets, Cincinnati, Ohio
Time and Place: Second Wednesday night of month, November through May. University Club, Fourth and Broadway

COLLEGE OF PHYSICIANS OF PHILADELPHIA, SECTION ON OPHTHALMOLOGY
Chairman: Dr. Wilfred E. Fry
Clerk: Dr. M. Luther Kauffman, Medical Arts Building, Jenkintown, Pa.
Time and Place: 8:15 p.m., third Thursday of every month, October through April. College of Physicians Building

DALLAS ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. W. B. Wilkinson
Secretary: Dr. Claude D. Winborn, Medical Arts Building, Dallas 1, Texas
Time and Place: First Tuesday of each month. Melrose Hotel

DES MOINES ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. J. H. McNamee
Secretary-Treasurer: Dr. H. H. Gurau, 213 Bankers Trust Building, Des Moines, Iowa
Time and Place: 6:00 p.m., fourth Monday of each month, September through May. Des Moines Club

THE DETROIT OTO-LARYNGOLOGICAL SOCIETY
President: Dr. B. F. Glowacki
Secretary-Treasurer: Dr. John R. Birch, 1010 Maccabees Building, Detroit 2, Mich.
Time and Place: Third Wednesday of each month, September to May. Wayne County Medical Society Building

EASTERN NEW YORK EYE, EAR, NOSE AND THROAT ASSOCIATION
President: Dr. John H. Sulzman
Secretary-Treasurer: Dr. E. Martin Freund, 762 Madison Avenue, Albany 3, N. Y.
Time and Place: 8 p.m., first Thursday of month, October to June. Albany, Troy, Schenectady, rotating monthly

FORT WORTH EYE, EAR, NOSE AND THROAT SOCIETY
President: Dr. W. H. McKenzie
Secretary: Dr. C. Keith Barnes, 921 Neil P. Anderson Building, Fort Worth 2, Texas
Time and Place: 6:30 p.m., first Friday of each month, except July and August. All Saints' Hospital

HOUSTON ACADEMY OF MEDICINE, OPHTHALMOLOGICAL AND OTO-LARYNGOLOGICAL SECTION
President: Dr. Lyle Hooker
Secretary: Dr. Claude C. Cody, III, 1304 Walker Avenue, Houston 2, Texas
Time: Second Thursday of each month, October through June

INDIANAPOLIS OPHTHALMOLOGICAL AND OTO-LARYNGOLOGICAL SOCIETY
President: Dr. Alan L. Sparks
Secretary-Treasurer: Dr. J. Lawrence Sims, 809 Hume Mansur Building, Indianapolis 4, Ind.
Time and Place: 6:30 p.m., second Thursday of each month, November to May. Indianapolis Athletic Club

KANSAS CITY SOCIETY OF O. O. R. L.
President: Dr. John McLeod
Secretary: Dr. James W. May, 1016 Rialto Building, Kansas City, Mo.
Time and Place: Third Thursday of the month, November through May. Hotel President, 14th and Baltimore

LONG BEACH EYE, EAR, NOSE AND THROAT SOCIETY
President: Dr. Edmund D. Godwin
Secretary: Dr. James V. Keipp, 110 Pine Avenue, Long Beach 2, Calif.
Time and Place: 6:00 p.m., monthly, September through May. Seaside Memorial Hospital

LOS ANGELES OPHTHALMOLOGICAL SOCIETY

President: Dr. Deane C. Hartman
Secretary: Dr. Daniel B. Esterly, 104 North Madison Avenue, Pasadena 1, Calif.
Time and Place: First Thursday of each month, September through June. Los Angeles County Medical Society Building, 1925 Wilshire Boulevard

LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. Alden H. Miller
Secretary: Dr. Victor Goodhill, 2007 Wilshire Boulevard, Los Angeles 5, Calif.
Time and Place: 6:00 p.m., fourth Monday of each month, September through May. Los Angeles County Medical Association Building, 1925 Wilshire Boulevard

MEDICAL SOCIETY OF THE DISTRICT OF COLUMBIA, SECTION ON OTOLARYNGOLOGY

President: Dr. Don S. Knowlton
Secretary: Dr. Irvin Feldman, 1722 Eye St., N.W., Washington 6, D. C.
Time and Place: Third Tuesday in October, November, January, March and May. Army and Navy Club, 17th and Farragut Square, N.W.

MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

Chairman: Each member, in alphabetical order
Secretary: Dr. Sam H. Sanders, 1089 Madison Avenue, Memphis, Tenn.
Time and Place: Second Tuesday in each month, September through May. Memphis Eye, Ear, Nose and Throat Hospital

MILWAUKEE OTO-OPHTHALMIC SOCIETY

President: Dr. G. O. Dunker
Secretary: Dr. B. P. Churchill, 1729 South 11th Street, Milwaukee, Wis.
Time and Place: 6:30 p.m., fourth Tuesday of each month, October to May. Athletic Club

MONTGOMERY COUNTY MEDICAL SOCIETY, SECTION ON EYE, EAR, NOSE AND THROAT

President: Dr. Robert A. Bruce
Secretary-Treasurer: Dr. L. N. Shroder, 144 West Fourth Street, Greenville, Ohio
Time and Place: First Tuesday of November, February, March and May. Dayton Country Club

MONTREAL OPHTHALMOLOGICAL SOCIETY

President: Dr. B. Alexander
Secretary-Treasurer: Dr. Roland Cloutier, Medical Arts Building, Montreal 25, Canada
Time: Second Thursday of October, December, February and April

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

President: Dr. Sidney A. Fox
Secretary: Dr. Leon H. Ehrlich, 211 Central Park West, New York 24, N. Y.
Time and Place: First Monday of the month, October to May. New York Academy of Medicine

NUECES COUNTY EYE, EAR, NOSE AND THROAT SOCIETY

President: Dr. C. N. Meador
Secretary: Dr. Rex C. House, 228 Medical-Dental Building, Corpus Christi, Texas
Time and Place: 7:30 p.m., second Monday of each month, October through May. Dusty's, 1739 South Brownlee Street, Corpus Christi, Texas

OKLAHOMA CITY ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. C. W. McClure
Secretary: Dr. Richard A. Clay, 416 Northwest 13th Street, Oklahoma City, Okla.
Time and Place: First Tuesday of each month. University Hospital, 800 Northeast 13th Street, Oklahoma City

OMAHA AND COUNCIL BLUFFS OPHTHALMOLOGICAL AND OTOLARYNGOLOGICAL SOCIETY

President: Dr. Thomas T. Smith
Secretary-Treasurer: Dr. G. T. Alliband, 1020 Medical Arts Building, Omaha, Neb.
Time and Place: Dinner meeting third Wednesday monthly, October to May. Omaha Club

PHILADELPHIA COUNTY MEDICAL SOCIETY, EYE SECTION

Chairman: Dr. Alfred Cowan
Secretary: Dr. John W. Deichler, 301 South 21st Street, Philadelphia 3, Pa.
Time: First Thursday of each month, November through April

PUGET SOUND ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. Frank H. Wanamaker
Secretary-Treasurer: Dr. Willard F. Goff, 432 Stimson Building, 1215 Fourth Avenue, Seattle 1, Wash.
Time and Place: Third Tuesday of each month. Medical-Dental Building, Seattle

READING EYE, EAR, NOSE AND THROAT SOCIETY

President: Dr. William J. Hertz
Secretary: Dr. Paul C. Craig, 232 North Fifth Street, Reading, Pa.
Time and Place: Third Wednesday of each month, September to July (dinner meetings). Wyomissing Club

RICHMOND, VIRGINIA, EYE, EAR, NOSE AND THROAT SOCIETY

President: Dr. E. W. Perkins
Secretary-Treasurer: Dr. J. Warren Montague, 1001 West Franklin Street, Richmond 20, Va.
Time and Place: First Tuesday of January, March, May and October. Commonwealth Club

ST. LOUIS COUNTY MEDICAL SOCIETY, SECTION ON EYE, EAR, NOSE AND THROAT

Chairman: Dr. Anderson C. Hilding
Secretary: Dr. James P. Tetlie, 626 Medical Arts Building, Duluth, Minn.
Time and Place: 6:00 to 8:00 p.m., preceding the monthly St. Louis County Medical Society meeting. St. Mary's Hospital, Duluth

ST. LOUIS OPHTHALMIC SOCIETY

President: Dr. Lawrence T. Post
Secretary: Dr. James H. Bryan, 330-332 Beaumont Medical Building, St. Louis 8, Mo.
Time and Place: 8:00 p.m., fourth Friday of each month, October through April, except December. Elliott Auditorium, McMillan Hospital

SAN FRANCISCO COUNTY MEDICAL SOCIETY, SECTION ON EYE, EAR, NOSE AND THROAT

Chairman: Dr. W. E. Borley, 655 Sutter Street, San Francisco, Calif.
Secretary: None
Time and Place: Fourth Tuesday of each month, except July, August and December. San Francisco County Medical Society Building

SPOKANE ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. Phil Greene
Secretary: Dr. Cornelius E. Hagan, Jr., 508 Old National Bank Building, Spokane, Wash.
Time and Place: Fourth Tuesday of each month, September through May. Paulsen Medical and Dental Building

SUPERIOR CALIFORNIA EYE CLUB

President: Dr. Theodore Holstein, 523 Medico-Dental Building, Sacramento 14, Calif.
Secretary: Dr. John Berg
Time: Every third Thursday, eight months of the year

TORONTO ACADEMY OF MEDICINE, SECTION OF OPHTHALMOLOGY

Chairman: Dr. A. Lloyd Morgan
Secretary: Dr. Joseph C. Hill, 174 St. George Street, Toronto 5, Ontario, Canada
Time and Place: Second Monday night of November, January, February and March. Academy of Medicine, Toronto

WASHINGTON, D. C. OPHTHALMOLOGICAL SOCIETY

President: Dr. J. Thomas Schnebly
Secretary-Treasurer: Dr. E. S. Caldemeyer, 1826 R Street, N.W., Washington 9, D. C.
Time and Place: Bimonthly, October through May. Kennedy-Warren Hotel

WESTERN PENNSYLVANIA EYE, EAR, NOSE AND THROAT SOCIETY

President: Dr. C. E. Imbrie
Secretary-Treasurer: Dr. F. E. Murdock, 28½ West Scribner Avenue, DuBois, Pa.
Time: Biannually. Third Thursdays of May and October

WILKES-BARRE OPHTHALMOLOGICAL SOCIETY

President: Dr. Vincent Gallizzi
Secretary: Dr. Samuel T. Buckman, 70 South Franklin Street, Wilkes-Barre, Pa.
Time and Place: Last Tuesday of each month, October through May, except December. Luzerne County Medical Society Library, 130 South Franklin Street

HEARING AIDS ACCEPTED BY THE COUNCIL ON PHYSICAL MEDICINE AND REHABILITATION THE AMERICAN MEDICAL ASSOCIATION

As of February 1, 1950

Aurex Model F ..... JAMA 138:294 (Sept. 25) 1948
Aurex Model H ..... JAMA 136:1099 (April 24) 1948

MFR. AUREX CORP.
1117 N. Franklin St., Chicago 10, Ill.

Beltone Mono-Pac ..... JAMA 130:637 (March 9) 1946
Beltone Harmony Mono-Pac ..... JAMA 133:543 (Feb. 22) 1947
Beltone Symphonette ..... JAMA 140:1217 (Aug. 13) 1949

MFR. BELTONE HEARING AID CO.
1450 W. Nineteenth St., Chicago 8, Ill.

Dysonic Model No. 1 ..... JAMA 137:1534 (Aug. 21) 1948

MFR. DYNAMIC HEARING AIDS, INC.
1042 Atlantic Ave., Brooklyn 16, N. Y.

Electrocar Model C ..... JAMA 136:769 (March 13) 1948

MFR. AMERICAN EARPHONE CO., INC.
10 E. Forty-third St., New York 17, N. Y.

Gem Hearing Aid Model V-35 ..... JAMA 139:229 (Jan. 22) 1949

MFR. GEM EAR PHONE CO., INC.
80 Franklin St., New York 13, N. Y.

Maico Type K ..... JAMA 129:32 (Sept. 1) 1945
Maico Atomeer ..... JAMA 133:542 (Feb. 22) 1947

MFR. MAICO CO., INC.
21 N. Third St., Minneapolis 1, Minn.

Mears Aurophone Model 200 ..... JAMA 138:428 (Oct. 9) 1948
1947-Mears Aurophone Model 98 ..... JAMA 137:1535 (Aug. 21) 1948

MFR. MEARS RADIO HEARING DEVICE CORP.
1 W. Thirty-fourth St., New York 1, N. Y.

Micronic Model 101 (Magnetic Receiver) ..... JAMA 139:99 (Jan. 8) 1949
Micronic Model 303 ..... Report not yet published

MFR. MICRONIC CO.
727 Atlantic Ave., Boston 11, Mass.

Microtone T-3 Audiomatic ..... JAMA 138:1229 (Dec. 25) 1948
Microtone T-4 Audiomatic ..... JAMA 136:109 (Jan. 10) 1948
Microtone T-5 Audiomatic ..... JAMA 139:379 (Feb. 5) 1949

MFR. MICROTONE CO.
Ford Parkway on Mississippi, St. Paul 5, Minn.

National Cub Model ..... JAMA 138:295 (Sept. 25) 1948
National Standard Model ..... JAMA 138:295 (Sept. 25) 1948
National Star Model ..... JAMA 138:295 (Sept. 25) 1948

MFR. NATIONAL HEARING AID LABORATORIES
815 S. Hill St., Los Angeles 14, Calif.

Otarion, Model E-1 ..... JAMA 136:108 (Jan. 10) 1948
Otarion, Model E-1S ..... JAMA 138:650 (Oct. 30) 1948
Otarion, Model E-2 ..... JAMA 138:887 (Nov. 20) 1948
Otarion, Model E-4 ..... JAMA 140:156 (May 14) 1949

MFR. OTARION HEARING AIDS
159 N. Dearborn St., Chicago 1, Ill.

Paravox Models VH and VL ..... JAMA 132:79 (Sept. 14) 1946
Paravox Model XT ..... JAMA 134:365 (May 24) 1947
Paravox Model XTS ..... JAMA 136:109 (Jan. 10) 1948
Paravox Model Y (YM, YC & YC-7) ..... JAMA 140:155 (May 14) 1949

MFR. PARAVOX, INC.
2056 E. Fourth St., Cleveland 15, Ohio

Radioear Permo-Magnetic Uniphone ..... JAMA 139:787 (March 19) 1949
Radioear Permo-Magnetic Multipower ..... JAMA 140:959 (July 16) 1949

MFR. E. A. MYERS & SONS
306-08 Beverly Road, Mt. Lebanon, Pittsburgh 16, Pa.

Silver Micronic Hearing Aid, Model 101 ..... **JAMA 135:159 (Sept. 20) 1947**
Silver Micronic Hearing Aids, Models 202M & 202C ..... JAMA 139:848 (March 26) 1949
MFR. MICRONIC CO.
727 Atlantic Ave., Boston 11, Mass.

Silvertone Model 103BM ..... Report not yet published
DISTR. SEARS, ROEBUCK & CO.
Chicago 7, Ill.

Sonotone Model 600 ..... JAMA 131:523 (June 8) 1946
Sonotone Model 700 ..... JAMA 135:838 (Nov. 29) 1947
Sonotone Model 900 ..... JAMA 139:786 (March 19) 1949
Sonotone Models 910 and 920 ..... Report not yet published
MFR. SONOTONE CORP.
Elmsford, N. Y.

Superfonic Hearing Aid ..... JAMA 138:293 (Sept. 25) 1948
MFR. AMERICAN SOUND PRODUCTS, INC.
2454 S. Michigan Ave., Chicago 16, Ill.

Televox Model E ..... JAMA 140:783 (July 2) 1949
MFR. TELEVOX MFG. CO.
117 S. Broad St., Philadelphia 7, Pa.

Telex Model 22 ..... JAMA 134:605 (June 14) 1947
Telex Model 97 ..... JAMA 138:294 (Sept. 25) 1948
Telex Model 99 ..... JAMA 141:1153 (Dec. 17) 1949
Telex Model 1700 ..... JAMA 141:1057 (Dec. 10) 1949
MFR. TELEX, INC.
Telex Park, Minneapolis 1, Minn.

Tonemaster Model Royal ..... JAMA 139:848 (March 26) 1949
MFR. TONEMASTERS, INC.
1627 Pacific Ave., Dallas 1, Texas

Trimm Vacuum Tube Model 300 ..... JAMA 133:542 (Feb. 22) 1947
MFR. TRIMM, INC.
400 W. Lake St., Libertyville 1, Ill.

Unex Model "A" ..... JAMA 134:254 (May 17) 1947
Unex Midget Model 95 ..... JAMA 141:134 (Sept. 10) 1949
Unex Midget Model 110 ..... JAMA 141:134 (Sept. 10) 1949
MFR. NICHOLS & CLARK
Hathorne, Mass.

Vacolite Model J ..... JAMA 140:782 (July 2) 1949
MFG. VACOLITE CO.
3003 N. Henderson St., Dallas 6, Texas

Western Electric Model 63 ..... JAMA 131:895 (July 13) 1946
Western Electric Model 64 ..... JAMA 134:605 (June 14) 1947
Western Electric Models 65 & 66 ..... JAMA 137:534 (June 5) 1948
MFR. WESTERN ELECTRIC CO., INC.
120 Broadway, New York 5, N. Y.

Zenith Model 75 ..... JAMA 135:773 (Nov. 22) 1947
Zenith Miniature 75 ..... Report not yet published
MFR. ZENITH RADIO CORP.
6001 Dickens Ave., Chicago 39, Ill.

All of the above hearing devices employ vacuum tubes.
Accepted hearing aids more than five years old have been omitted from this list for brevity.

TABLE HEARING AIDS

Aurex (Semi-Portable) ..... JAMA 109:585 (Aug. 21) 1937
MFR. AUREX CORP.
1117 N. Franklin St., Chicago 10, Ill.

Precision Table Hearing Aid ..... JAMA 139:785,786 (March 19) 1949
MFR. PRECISION ELECTRONICS CO.
850 W. Oakdale Ave., Chicago 14, Ill.

Sonotone Professional Table Set, Model 50 ..... JAMA 141:658 (Nov. 5) 1949.
Elmsford, New York
MFR. SONOTONE CORP.

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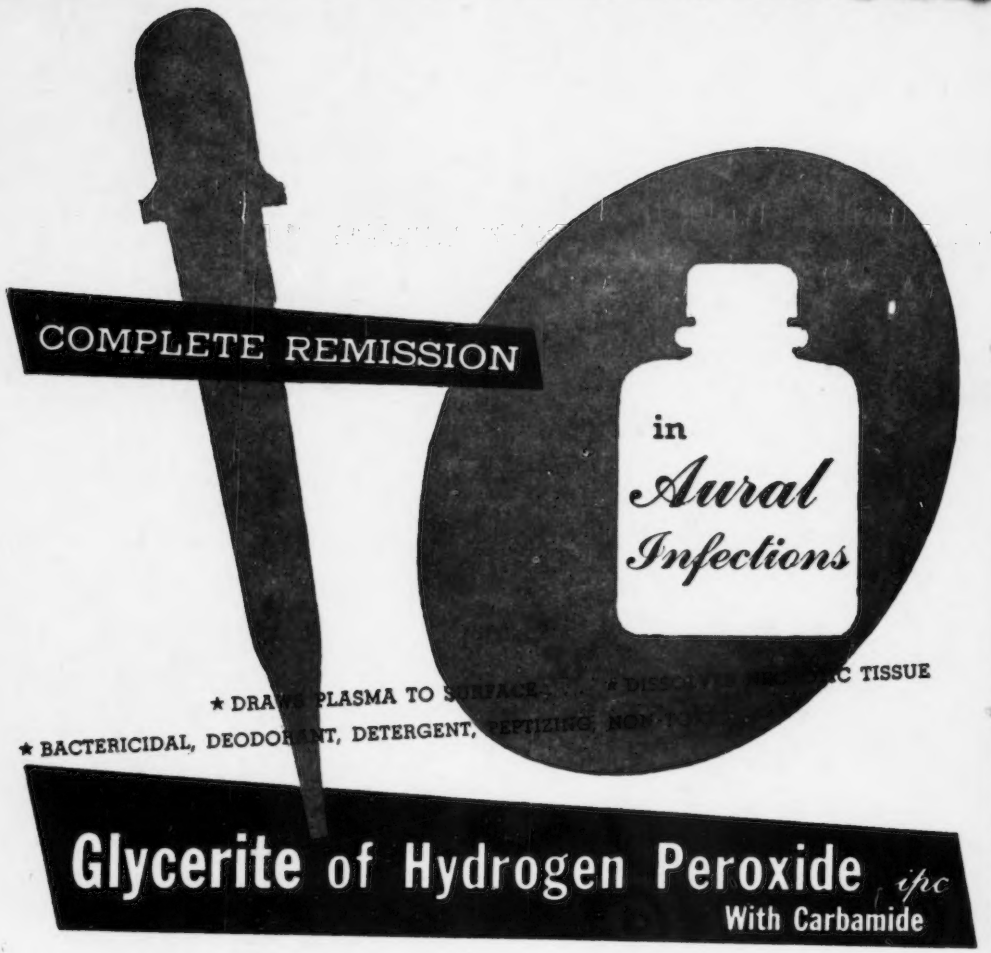

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★ BIBLIOGRAPHY
Arch. Otolaryngol., 43:605, 1946.
E., E., N., & T. Mo., 26:27, 1947.
Laryngoscope, 56:556, 1946.
New Eng. J. Med., 234:468, 1946.
Annals of Allergy, 4:33, 1946.
J. A. Ph., A., (Sc. Ed.) 35:304, 1946.
Literature on request.

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